FFICIAL JOURNAL OF THE AMERICAN COLLEGE OF SURGEONS
NUAL SUBSCRIPTION: UNITED STATES AND CANADA, $12.00; FOREIGN, $14.00.

Volume XXXVI MARCH, 1923 Number 3

Surgery, Gynecology and Obstetrics

WITH

International Abstract of Surgery

EDITORIAL STAFF

FOR AMERICAN COLLEGE OF SURGEONS

William J. Mayo, M.D.

Albert J. Ochsner, M.D. John M. T. Finney, M.D.

George W. Crile, M.D. Harvey Cushing, M.D. J. Bentley Squier, M.D.

George E. de Schweinitz, M.D. John L. Porter, M.D. T. J. Watkins, M.D.

E. Wyllys Andrews, M.D. Frederic A. Besley, M.D. W. R. Cubbins, M.D.

George E. Armstrong, M.D. Rudolph Matas, M.D.

FOR THE BRITISH EMPIRE

Sir Arthur Mayo-Robson, K.B.E., C.B., C.V.O., D.Sc.

Sir Berkeley Moynihan, K.C.M.G., C.B. J. Rutherford Morison, M.B., F.R.C.S.

Sir Harold J. Stiles, K.B.E., F.R.C.S. (Edin.) Thomas W. Eden, M.D., F.R.C.S.

Sir William de C. Wheeler, M.D., F.R.C.S.I.

Franklin H. Martin, M.D., Managing Editor

Allen B. Kanavel, M.D., Associate Editor

EDITORIAL AND BUSINESS OFFICES: 30 N. Michigan Ave., Chicago, Illinois, U. S. A.

PUBLISHERS FOR GREAT BRITAIN: Bailliere, Tindall & Cox, 8 Henrietta St., Covent Garden, London, W. C., England

Gant's Work is Ready

Rectum—Anus—Colon

SAUNDERS, *Publishers* SEE PAGE 13

Entered as second-class matter May 12, 1913, at the postoffice at Chicago, Ill., under the Act of Congress, March 3, 1879.

Published monthly. Copyright, 1923, by The Surgical Publishing Company of Chicago.

EVERY SURGEON NEEDS IT

BRADY'S POTTER-BUCKY DIAPHRAGM

No surgeon should operate without the best information on internal conditions that can be secured only when a Potter-Bucky Diaphragm is used in the X-Ray Laboratory. You should insist on your X-Ray man at least TRYING one to assure himself and yourself of the truth of this.

Gives especially fine detail on heavy parts such as spine, kidney, gall-bladder, pelvis, etc., impossible to secure in any other way. THE GREATEST AID TO FINE RADIOGRAPHY EVER PRODUCED. The smallest, neatest and most accurate Bucky made.

New model with many improvements, price $250.00, less 10 per cent cash discount for prompt payment. Try it and be convinced.

EVERYTHING IN X-RAY SUPPLIES

We carry a large stock of all X-Ray supplies, including Duplitized Films, Plates, Intensifying Screens, Developer, Dental Film Mounts, Developing Tanks, Coolidge Tubes, etc. Get our Price List and Discount before buying. Prompt shipment, always.

GEO. W. BRADY & CO., 756 So. Western Ave., Chicago, Ill.

BACTERIAL VACCINES

IMMUNOLOGICAL RESEARCH

BACTERIAL DIAGNOSIS

BACTERIOLOGICAL LABORATORIES OF

G. H. SHERMAN, M.D.

DETROIT MICHIGAN

Figs. 1 and 2. Color sketches (natural size) of the original bone flap showing at left the external tumor, and at right the internal tumor, the crater being the point at which the fragment was removed for examination.

Surgical End-Results in General; with a Case of Cavernous Hæmangioma of the Skull in Particular.—Harvey Cushing.

SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE PUBLISHED MONTHLY

VOLUME XXXVI MARCH, 1923 NUMBER 3

SURGICAL END-RESULTS IN GENERAL

WITH A CASE OF CAVERNOUS HÆMANGIOMA OF THE SKULL IN PARTICULAR[1]

BY HARVEY CUSHING, M.D., F.A.C.S.

THE medical profession is essentially gregarious. There is no other profession equally so, and, because of this trait, the medical society, where experiences may be interchanged, becomes the most effective agency for the diffusion of knowledge—even more effective than our extensive literature. Certain kinds of information, however, are conveyed far better by onlooking than by studying the printed page, and in so far as surgery is a craft its newer lessons can best be transmitted by observing the manipulations of others.

In days gone by, all of our societies, even the strictly surgical ones, were almost wholly subjective in their methods of teaching. The members sat and listened to subjective expositions. This went on until 20 years ago, when a small group of American surgeons founded a society into which the opposite principle was introduced—the objective method of exposition. In rotation its members met in the several institutions they represented, in order to see one another at work—at the operating table, in the laboratory, at the bedside, in the classroom before their students. These meetings, at which no papers were read, proved a great success, and the established usage of this society has become widely copied, particularly by small groups of surgeons both at home and abroad. So great a success was it that the principle came to be adopted wholesale by the Clinical Congress of Surgeons, and so eager was the demand for the opportunities offered through this agency to see an entire community of surgeons engaged in their tasks, that the gatherings became utterly unwieldy.

Out of this has grown the present College, modeled in certain of its customs on the Royal College of Surgeons of England. But the chief function of the three Colleges of Surgeons of London, of Edinburgh and of Dublin, is that of a licensing body, and with this we have nothing to do. However, the founders of the American College had no intention of its becoming merely a club. They have set out deliberately to make a membership in the body highly desirable for other than social reasons.

Surgery has become the chief therapeutic resource of the profession. Those of us who engage in it are better aware than any others, of its commercializing opportunities and temptations, so largely the outgrowth of specialization. Accordingly, certain very-much-needed reforms have been inaugurated by the College—reforms the object of which is to render impossible the barter of patients on the part of those members of the profession, both in and out of our particular craft, who could never have read or pondered over the Hippocratic oath and who ignore the Golden Rule.

[1] Presidential Address before the Clinical Congress of American College of Surgeons, Boston, October 23, 1922.

But granting honesty of purpose and professional idealism in the vast majority, the College has set about further to safeguard those subjected to surgical operations in two ways: first, by putting its seal on those who may be considered sufficiently well trained to undertake major operations; and, secondly, by seeing to it that the hospitals in which such procedures are carried out are properly organized and conducted.

There may be some doubt regarding the entire success of the former endeavor—the fair bestowal of the College hall-mark. There are men both in and out of almost any society that can be named, who should not be. But there can be no question of the success of the movement for the betterment of the hospitals: and the educational campaign which has attended their survey has been of far-reaching importance. The laity and hospital Boards understand better what manner of man the surgeon should be and how hospitals should be conducted. The hospital surgeon, generally speaking, has come, on the other hand, to take himself and his institutional responsibilities far more seriously than once was his inclination.

With all this, the holding of these annual meetings has little to do. What is more, the large public operating clinics, a relic of the original Congress, lie open to very serious temptations and objections. Few surgeons can do their best work when elbowed by an undue number of onlookers, and their customary judgment and resourcefulness in emergencies may be seriously affected by the inescapable distractions associated with the entertainment of, and provision for, a large number of guests. This is the experience of every surgeon who has a conscience. It is true that a home team has an advantage over a visiting team, but even the home team, however steady under ordinary circumstances, is apt to pile up errors in a bad inning under the unusual stress of a championship series. And a surgical team is engaged in a far more responsible business than a ball-game.

It is with some such ideas in mind that the local committee has felt inclined to eliminate, so far as possible, as unsuited to a large assemblage, the more purely operative features which largely characterized the program of the original clinical congresses. With its avowed purpose of safeguarding the patient, the College cannot put its stamp of approval on a custom which may tempt some of its members either to rush through the preliminary studies of a newly admitted patient or, what is equally culpable, to hold over for the purposes of the meeting operations which might better have been done without delay. Furthermore, an objectionable degree of publicity has been a distinct evil of former meetings of the Congress. As a rule, the better the surgeon the more unassuming he is and the more he abhors seeing reference to his work in the lay press.

Certainly the College cannot wish to foster the mere spectacularization of surgery, so prevalent in days gone by, and the Boston members have decided to follow again the same course they pursued when the Congress met here before—the only course they can see whereby this tendency can in a measure be offset—namely, by a subsequent report, to be published in the official organ of this body, not only of the immediate but of the late results of all the public operations performed in the Boston hospitals before members of the College at this meeting.

There is no doubt but that one craftsman profits by seeing another craftsman at work, but if a few hundred artists should stand at the elbow of Mr. John Sargent while he is in the process of painting a portrait, it would in all likelihood so modify his customary performance that the sitter might with very good reason be dissatisfied with what may be spoken of in surgical parlance as the end-result. There is unquestionably a great deal of artistry about a well-conducted operation, but surely as surgeons we are not content to be mere manipulators and piece-workers—more interested in the technique than in the portrait. The important thing in surgery is not operative dexterity but what the patient looks like after you and I have removed our gloves, and what he is subsequently able to do with what we have left of him.

A good deal of this end-result discussion has emanated from the community in which we now meet, and not a little of it through

the expostulations of one person, who finally under the auspices of the College has undertaken, as a type-study, the investigation of the operative results of a single pathological lesion—the sarcomata of bone. It is not a question of how many legs or arms have been amputated for osteosarcomata, nor how many seconds it took to "drop the limb," a matter which chiefly interested our forebears, nor, indeed, by what particular method the operation was performed. The important questions are whether the amputation should have been done at all in view of the pathology of the lesion, and, granting an immediate recovery, whether the individual's expectation of life has been augmented. No doubt there have been, with all good intent, an unnecessary number of limbs sacrificed, just as there have been an unnecessary number of easily detached furnishings,—tubes, gall bladders, and appendices, tonsils, teeth, and turbinates,—piled on the altar of Æsculapius.

But let us settle, so far as we may, one thing at a time. And even this proves difficult enough. A clinical diagnosis of sarcoma of the tibia has been made, followed by amputation and a confirmatory pathological report on the nature of the lesion. The patient has survived for an unexpected number of years. No record of the case has been kept and the tissues have been discarded, even the histological preparations thrown aside. Does this long survival mean good surgery or an erroneous diagnosis? Was the tumor non-malignant in the beginning? Could the limb have been saved? These are questions difficult to answer, nor would a correct answer serve now to benefit this hypothetical patient. But tomorrow any one of us may be confronted by a similar problem in its relation to some patient of our own.

Only by the whole-hearted co-operation of a large body of surgeons, who have kept detailed and reliable records, can a reasonably exact answer be given to such a question as the operability of the various sarcomata of bone, and it is to secure this that the committee which has been at work on the subject has received the backing of the College. It unquestionably is something of a nuisance to each of us individually to interrupt our own personal investigations in other fields, long enough to add our small quota of percentages to what may seem time-worn problems that interest others more than ourselves, but there are many of these problems which can be solved only by the statistical study of a large mass of material, and it is well worth the trouble if someone is willing to take it, even if it saves only one occasional leg in the community.

My own feeling in the matter is that if the College wishes to lend its influence to studies of this sort it can best do so through the agency of the hospitals as an outgrowth and side-issue of its campaign of standardization. There could be no better way of gauging the working conditions in a given hospital than by the character of a report it would submit on some such question as, let us say, the results, immediate and remote, of the operations for cancer of the breast, covering a given decade. Such a report would reveal at a glance not only the quality of the operative work itself, but how carefully it was safeguarded—how correct were the diagnoses leading to the operation; how thorough the pathological studies; how dependable were the hospital case records; how conscientious the hospital in its quest for information concerning the ultimate results. If in each of the Class A hospitals some young member of the staff were given as his particular study for the year an analysis of all the cases of bone sarcoma recorded in the hospital files, and an effort were made to recall for re-examination, or at least to get reports from, all individuals still surviving, the information the College and its committee unselfishly desires in respect to this single problem could be easily obtained.

Every hospital, after its own method, has some sort of an annual publication, containing for the most part statistics and enumerations, of interest largely to administrators alone. These things are doubtless necessary for good housekeeping. But I would suggest that in place of the futile lists of diseases and operations which encumber these publications, the hospitals be requested to include each year a concise report upon some particular clinical problem to be selected by the Regents of the College. In this way ample data for almost

any required statistical study could be secured, and the process would lead to a very desirable regrouping of the institutions already on the acceptable list, into those which keep sufficiently reliable and complete records of their patients and those which do not. Let us hope that the College will take advantage of some such method of securing for analysis a mass of information such as that of which the committee now investigating the sarcomata of bone is in need. And when that has been obtained, let us turn to such other topics as can be illuminated in similar fashion through statistical studies, year after year.

I have been led to write this preamble concerning surgical end-results in general, the better to explain my reason for putting on record at this time some notes regarding a case which for three years masqueraded in the Brigham Hospital records as a melanotic sarcoma of the skull. I do so at the request of my persistent friend, Dr. E. A. Codman, though my inclinations would have led me to wait until I had learned something more about the condition by the opportunity of comparing it with other and similar lesions. It is true that this opportunity might never come. Though provisionally diagnosed as a melanotic bone sarcoma, probably metastatic, the case proves, from the evidence of time as well as from the evidence of subsequent histological studies, to be a tumor of less malignant nature than had originally been supposed. It is this, I believe, that Dr. Codman particularly wishes to have emphasized: namely, that a diagnosis of bone sarcoma in cases which have long survived operation must be received with skepticism until the original records of the case have been scrutinized anew with the greatest care. With this feeling I am fully in accord, and there is no question but that the following history is a good example of the diagnostic slips and pitfalls which surround all of us.

The patient (P.B.B.H. Surgical No. 10669), Mrs. C., was a woman of fifty-five years who was admitted to the Brigham Hospital June 20, 1919, because of a dome-shaped, bony prominence of the left parietal region which at first sight was regarded as the hyperostosis overlying a meningioma (dural endothelioma). Five years before her entrance she had bumped her head severely at this particular spot. The place remained sore and in the course of a year there slowly developed a slight prominence with some tenderness to pressure and a dull, uncomfortable ache. This swelling during the preceding few months had been enlarging somewhat more rapidly.

Apart from this bony tumor, her physical examination revealed no abnormalities. There were no localizing symptoms indicating any intracranial involvement, but the meningiomata not uncommonly fail to cause cerebral symptoms, even when these tumors reach a large size, and, what is more, the flat rather than the rounded types of these growths appear to be the ones which most often provoke some thickening of the overlying skull. The X-ray, however, did not tend to confirm the bedside diagnosis, for there was a well-outlined patch of rarefaction corresponding to the bony protrusion which was variously interpreted as due to a possible cholesteatoma, gumma, sarcoma, or bone-cyst.

At the operation a cranial flap was outlined, so as to give the involved area a generous margin, and on reflecting the flap a most unusual picture presented itself. Projecting within the skull were two fairly well-outlined prominent bosses of tumor as shown in the accompanying sketch—a tumor, moreover, of purplish-black color which had an appearance suggesting a melanoma. The dura was indented by, and was slightly adherent to the nodules, which were about a centimeter in height, firm as bone, and somewhat "thimbled" as to their surface.

Greatly distressed by this disclosure, I assumed that the growth must be the metastasis of a melanotic sarcoma, the original source of which had been overlooked. Accordingly for purposes of histological confirmation a small fragment was curetted out for immediate study. A report was returned that on crushing the tissue and examining the cells they were found to be both round and spindle-shaped, and to contain blackish-brown pigment in the form of fine granules—diagnosis, melanotic sarcoma. In view of this report it was presumable that there were corresponding metastases elsewhere, but nevertheless the exposed lesion was so definitely centered in the flap that the decision was made to sacrifice the bone, and on stripping it away from the scalp the external portion of the dark-colored tumor which adhered slightly to the pericranium (Fig. 2, frontispiece) was revealed. The growth proved to be about 3 centimeters in thickness.

The patient in the usual detail had been thoroughly examined before the operation, but subsequently she was again gone over from top to toe in order to see whether we might not possibly have somewhere overlooked a primary melanoma. Though nothing was found in skin or retina, I knew from a sorry experience that there nevertheless might be a primary focus hidden somewhere in the body.

The experience to which I refer was as follows. A young woman with symptoms of a parietal-lobe tumor was operated upon many years ago in the

Fig. 3. Roentgenogram showing (poorly) the area of bone thinning in right parietal region at seat of the tumor.

Fig. 4. Path. No. P.B.B.H. S-19-432. Histological appearance of the cavernous angioma (Mag. ×33).

Johns Hopkins Hospital, and a purplish-black growth the size of a hen's egg was encountered and easily enucleated. The histological examination showed it to be a melanotic sarcoma, and she was thoroughly re-examined for a possible primary source of origin without one being found. She made a perfect temporary recovery, but some months later because of a return of her cerebral symptoms she re-entered the hospital, to end her days there. A postmortem examination disclosed multiple cerebral metastases and a primary melanotic sarcoma in a small dermoid cyst of the left ovary.

But to return to the patient in question. She had an uneventful convalescence, accepted my explanation and apologies for having left such a large defect in her cranium, and was discharged July 1, 10 days after the operation. And now comes the part of the story which chiefly concerns our present topic.

The specimen was an unusual one. It was carefully described for the pathological records and the accompanying color sketch was made of it. Meanwhile the pathologist's report based on the fresh-tissue examination alone, had been forwarded to the record-room and the diagnosis of melanotic sarcoma was inscribed on the history. An index card in correspondence was made out for the files and the case soon forgotten.

The patient was not heard from for 2 years, when, in answer to the routine letter of inquiry which we are accustomed to send to all patients after that interval, she replied, contrary to expectation, that she was perfectly well and had dismissed from mind her old trouble.

This unexpectedly favorable report led to a re-examination of the specimen and a block was sawn from the tumor for decalcification and sectioning. It was in midsummer, there had been a change of technicians and a new pathological assistant. The specimen was side-tracked, appears never to have been sectioned, and the inquiry regarding the case again became submerged by a succession of other more pressing matters.

A year later, by now 3 years after the operation, enters the bone-sarcoma committee, and one of our house officers was asked to prepare for them the data they requested in regard to the Brigham Hospital series of cases. Mrs. C.'s case was included, and ere long, word was received from Dr. Codman expressing doubts regarding a three-year survival of a patient with a melanotic sarcoma of the skull. Whereupon we found to our humiliation that the diagnosis still remained based upon the original fresh-tissue examination. A new section was removed and decalcified, and the growth proves, in the opinion of Dr. S. B. Wolbach, to be a cavernous hæmangioma—a comparatively benign tumor (cf. Fig. 3).[1]

This, Gentlemen of the College, is my entire story. Its moral is obvious. Fortunately the error in our pathological diagnosis has made no vital difference to the patient, though I would greatly have preferred to have left her with less of a cranial defect, and I presume the growth might have been treated locally—possibly, indeed, by radiation. The lesson is that any one of us may at any time acquire an utterly erroneous impression regarding a pathological lesion and the effectiveness of our operative procedure in a given

[1] This appears to be a particularly rare lesion in the cranial bones. A case of similar nature was reported by George Schoene in 1905 in the Julius Arnold Festschrift. ("Ueber einen Fall von myelogenen Haemangiom des Os occipitale." Beitr. z. path. Anat. u. z. allg. Path., Jena, 1905, vii, sup., 685-701.)

case. As a matter of fact, I understand that it is the experience of the Registry that at least two out of three cases recorded as sarcomata of bone prove in the opinion of the committee to be some other lesion.

Experience is the chief asset of a physician or surgeon, and possibly none is so valuable as that gained by our mistakes and errors of judgment. But knowledge to be exact must be based on something more than operating-room and bedside impressions. The only possible way to avoid the accumulation in our minds of inexact impressions regarding the results of our operative procedures for one condition or another is by a properly organized follow-up system which brings knowledge of the ultimate results not only to the hospital record-room, but vividly before us as individuals.

To be sure, I have illustrated these remarks by an isolated experience with a rare lesion, but we are just as prone to gain impressions which may be unjustified regarding our more routine performances. Though our bad results sometimes haunt us, patients who have suffered unnecessary or unsuccessful operations at our hands are likely to consult someone else and leave us in blissful ignorance of our failures unless we deliberately as individuals or as representatives of institutions set ourselves to pursue the maladies of our patients to their conclusion.

In this pursuit, moreover, we cannot effectively act alone, for we need to compare our results with those of other individuals or of other groups of individuals in other hospitals if we are to determine whether the best attainable results are being approximated in a series of operations for any given condition. In a co-operative study of this sort some sympathetic central agency like this College, which does not presume to act as a board of censors for individuals or hospitals, but which desires to improve not only the institutional conditions under which surgical operations are performed but to safeguard, as well, the character of these operations, can play a very important rôle.

EMBOLECTOMY IN THE TREATMENT OF CIRCULATORY DISTURBANCES IN THE EXTREMITIES[1]

By Dr. EINAR KEY, Stockholm, Sweden
Director and Surgeon-in-Chief, Maria Hospital

ONE of the most satisfactory operations that can be performed is the removal of an embolus by means of arteriotomy (embolectomy) in suitable cases. This has been made possible through the development of the technique in operations on the vessels of the body. Such a branch of surgery is consequently quite in its infancy, and the operations connected with it are not numerous. But more cases have occurred for operation during the last year, and the results of the operations have substantially improved. In order to establish the indications for embolectomy and to improve the technique at these operations, further experience is required, and every fresh observation is of great interest.

The first to try to remove an embolus by arteriotomy was Suabanejew (1895). Because of threatened gangrene in one leg as a result of an embolus, he performed arteriotomy upon the femoral artery (arteria femoralis) to remove the embolus. This was not successful; after amputation of the leg, the patient succumbed.

During the first decade of this century, several surgeons tried in vain to remove an embolus, or an arterial thrombus, by arteriotomy to restore the circulation and to prevent the development of gangrene. As one among the first to attempt this, the name of Francis Stewart must be mentioned. Also I wish to call to mind the interesting case operated upon by Murphy in 1908. The first completely successful embolectomy was performed in 1911 by Labey, who removed an embolus from the arteria femoralis communis,[2] 6 hours after its appearance. The second entirely successful case of embolectomy was carried out by me the year after. In my case also the embolus was in the arteria femoralis communis, and the operation was undertaken 6 hours after its appearance.

Since then, more and more cases have come for operation. I myself have had occasion to remove by arteriotomy an embolus that was producing circulatory disturbance in the extremities, 10 times on 9 patients (one had embolus in both legs). In these cases the emboli were located twice in the arteria femoralis communis, twice in both arteriæ femorales communes and arteria poplitea in the same leg, once in arteria femoralis communis and the arteria femoralis propria in one leg and in the arteria poplitea in the other, once in only the arteria poplitea, once in the bifurcation of the aorta and the arteria femoralis communis, once in the arteria axillaris and arteria brachialis, and once it was probably located in arteria iliaca with secondary thrombus formation extending into the arteria femoralis. In my cases, the operation was performed from 2 hours to 4 days after the earliest symptoms. Gangrene appeared after four of the operations. In the other cases, the result was good. Of the cases in which gangrene occurred, one was operated upon 4 hours after the first symptoms appeared, two after 15 and 43 hours respectively, and one not until the fourth day.

For the sake of comparison, I have been able, in addition to my own cases, to collect 51 cases from the literature and also cases operated upon by Swedish surgeons. In no instance has operation been fully successful when it has been done more than 24 hours after. In the accompanying table, I have grouped together cases that were operated upon within the 24 hours.

LOCALIZATION

An embolus will lodge most readily where a vessel divides. In the largest number of cases coming to operation, the embolus has been located in the dividing part of certain

[2] In this paper the term arteria femoralis communis indicates that part of the artery from the arteria iliaca externa from which the arteria femoralis profunda comes off from the arteria femoralis; and from this point to the arteria poplitea it is regarded as the arteria femoralis propria.

[1] From the Maria Hospital, Surgical Department, Stockholm, Sweden; read before the Clinical Congress of American College of Surgeons, Boston, October 23–26, 1922.

RESULT OF THE OPERATIONS PERFORMED WITHIN TWENTY-FOUR HOURS

Time between appearance of embolus and operation	GOOD				GANGRENE				DEATH SOON AFTER OPERATION			
	Time	Operator	Age of patient	Locality of embolus	Time	Operator	Age of patient	Locality of embolus	Time	Operator	Age of patient	Locality of embolus
1–5 hrs.	1½ hrs.	Michaelsson	39 yrs.	Art. femoralis								
	2 hrs.	Key, Case IV	43 yrs.	Art. femoralis	1½ hrs.	Borchgrevink	29 yrs.	Art. femoralis*				
	3 hrs.	Bauer	39 yrs.	Bifurcatio aortæ								
	3½ hrs.	Franzén	37 yrs.	Art. brachialis								
	4 hrs.	Key, Case III	57 yrs.	Art. femoralis and poplitea	Some hrs.	Lindström	61 yrs.	Art. poplitea				
	4½ hrs.	Key, Case V	61 yrs.	Art. axillaris and brachialis	4 hrs.	Key, Case IX	30 yrs.	Art. femoralis*				
	5 hrs.	Pupovac	25 yrs.	Art. femoralis								
6–10 hrs.	6 hrs.	Labey	38 yrs.	Art. femoralis					5¼ hrs.	Pallin	46 yrs.	Art. femoralis.
									6 hrs.	Rödén, Case V	67 yrs.	Art. femoralis and bifurcatio aortæ.
	6 hrs.	Key, Case I	43 yrs.	Art. femoralis					6 hrs.	Carlsson	68 yrs.	Art. femoralis.
	9 hrs.	Key, Case II		Art. poplitea					8 hrs.	Platon	54 yrs.	Art. poplitea.
	10 hrs.	Lundmark	40 yrs.	Art. axillaris								
11–15 hrs.	12 hrs.	Sundberg	63 yrs.	Art. femoralis	11½ hrs.	Rödén, Case IV	53 yrs.	Art. femoralis*	At least 12 hrs.	Lundblad	37 yrs.	Bifurcatio aortæ
	14 hrs.	Wideröe, Case I	49 yrs.	Art. axillaris	12 hrs.	Sjövall	46 yrs.	Bifurcatio aortæ*	14 hrs.	Proust	59 yrs.	Art. femoralis.
					13 hrs.	Matti	70 yrs.	Art. femoralis*				
					15 hrs.	Key, Case VI	34 yrs.	Art. femoralis et poplitea*				
16–20 hrs.	16 hrs.	Pupovac	25 yrs.	Art. femoralis	16½ hrs.	Wideröe, Case III	72 yrs.	Art. femoralis				
					20 hrs.	Wideröe, Case II	54 yrs.	Art. femoralis*				
					16½ hrs.	Rödén, Case IV	53 yrs.	Art. femoralis*				
21–24 hrs.	22½ hrs.	Key, Case VIII	44 yrs.	Bifurcatio aortæ and art. femoralis	24 hrs.	Wreden		Bifurcatio aortæ	23½ hrs.	Michaelsson, Case I	58 yrs.	Bifurcatio aortæ
	24 hrs.	Rödén, Case II	38 yrs.	Art. poplitea	24 hrs.	Petrén	48 yrs.	Art. femoralis communis*	24 hrs.	Ipsen, Case II	41 yrs.	Art. poplitea.

*After a time these cases have ended in death.

large vessels, such as bifurcatio aortae, parts of arteria iliaca communis, femoralis communis, poplitea and also in arteria axillaris where arteria subscapularis branches off. In some cases, the embolus which made necessary an operation had been preceded by other emboli which were so located that operation was not indicated. Sometimes after the operation, fresh emboli may appear. It is important to recognize that not infrequently two or more emboli indicating operation may occur in different parts. Such emboli may be located either in the chief artery of the same extremity or in another.

If an embolus is not removed, in time it generally goes through a stage of secondary thrombus building. As a result of this, an embolus which at first does not fully close the lumen, may become an obstruction. The embolus grows chiefly and most easily toward the periphery, but it may grow to a certain extent in a centripetal direction. Secondary thrombus building partially or totally impedes the collateral circulation, and in this way the danger of gangrene increases. The danger is also frequently augmented when the embolus appears in run-down individuals with weak heart action, which renders collateral circulation more difficult. Experience teaches that when an embolus is located at the division of the aorta, of the arteria iliaca communis, the arteria femoralis communis, the arteria poplitea, the arteria axillaris, and sometimes in the upper part of arteria brachialis, the danger of gangrene in the extremities is more or less grave.

The time for the appearance of secondary thrombus formation varies considerably. The danger of it generally increases with the time that elapses after an embolus has appeared. I have seen the beginning of a secondary thrombus formation as early as 2 hours after the appearance of an embolus. Sometimes, in late operation, it does not appear at all. Secondary thrombus formation renders operation more difficult and prognosis less favorable.

In cases which come early for treatment, it is generally easy to distinguish at the operation between the original embolus and the secondary thrombus; in later cases this may be difficult or impossible. Thus it may also be difficult or impossible in some cases to determine where the primary embolus was located.

SYMPTOMS

The symptoms may set in either suddenly, which is most usual, or more slowly and stealthily. In the former case, the embolus is so large that it causes serious disturbance to the circulation. In the latter case it obstructs only a part of the lumen in its first stage. Later, by the growth of secondary thrombus, or by the appearance of a new embolus, the lumen may become blocked, and the circulatory disturbances will consequently increase. In the former case the danger of gangrene is greater than in the latter when the collateral circulation has more time to become established. The degree of circulatory disturbance caused by the presence of an embolus depends upon whether it fully obstructs, upon the development of the collateral circulation, on the condition of the walls of the vessels, and on the action of the heart. Consequently, the intensity and extent of the circulatory disturbance differ considerably in different cases, from quite mild cases without danger of gangrene, to threatening gangrene of varying extent.

The symptoms that characterize an embolus are partly *subjective, partly objective. The subjective symptoms are:* pain, a sensation of cold, and disturbance of the sensibility. *The objective symptoms* are: change in color of the skin, lowering of temperature, disturbed motility, absence of skin and tendon reflexes, absence of pulsation.

The pain most often sets in suddenly, and this is highly significant. At the same time, the patient experiences a *sensation of cold and numbness* in the extremity affected. *The sensory disturbances* vary from a partial to a complete suspension of sensory function. The boundary of complete suspension is not often sharply defined, but the transition to partial suspension may be clearly observed.

Change of color. The suspension of circulation results in marked anæmia of the affected extremities, the temperature lowers, and the skin becomes deadly pale and possibly somewhat cyanotic Discoloration may be seen in livid to dark blue patches. The time when

* After a time these cases have ended in death.

these patches appear varies in different cases. As one would expect, anæmia and low temperature are most pronounced toward the periphery. A prick from a needle causes no bleeding. Motility is suspended or restricted in proportion to the degree of circulatory disturbance. The sensory disturbances, the change in color of the skin, and the part of the extremity that feels cold do not always fall quite within the same boundary, neither do they always quite correspond to those parts where the motility has been affected. The motility at least may apparently remain for some time in a part of the extremity which is cold and in which the sensory functions are suspended or impaired. The pulse below an embolus generally ceases. By palpation one can sometimes feel an embolus like a string in the painful part. The possibility of palpating an embolus depends upon its locality and on the corpulence of the patient. The emboli easy of access for palpation are those situated in the arteria femoralis communis, the upper part of the arteria femoralis propria and the lower part of the arteria axillaris and brachialis. It would be unusual to be able to palpate an embolus in the arteriæ iliacæ.

As the collaterals take over a part of the circulation, the limits of the region threatened with gangrene will be situated at a longer or shorter distance peripheral to the seat of the embolus, and they are not at first so sharply defined. The extent of the sphere threatened with gangrene by the situation of an embolus varies in different cases, as has been said, according to the development of the collaterals, the size of the embolus, the heart action, and also upon the stage reached by the secondary thrombus formation. Likewise, the symptoms of circulatory disturbance can diminish or disappear should an embolus situated in a position conducive to it again become detached and lodge more peripheral. If from being not quite obstructive, an embolus becomes so through secondary thrombus formation or through blocking up the collaterals, naturally the symptoms increase.

Some cases have precursory symptoms, probably depending upon a small embolus. In other cases, pronounced symptoms in another locality have preceded an embolus. It would take too long to go into the symptomatology of the various seats of an embolus.

DIAGNOSIS

The symptoms of an obstructing embolus appearing suddenly in the large vessel of the extremities, are so marked that the diagnosis is seldom difficult (sudden severe pain in the extremity, a feeling of cold and numbness, sensory and motor disturbance, and disturbance of the circulation). When the embolus is not entirely obstructive to begin with, but becomes so gradually by augmentation, the symptoms are often not so pronounced at first, and the diagnosis may be difficult.

With regard to differential diagnosis, it is of utmost importance to distinguish between an embolus and a *thrombus in the artery* due to arteritis. Indications of an embolus are a sudden onset of symptoms, and the fact that the patient has organic disease of the heart or the existence of an active predisposition to thrombus building as a result of an infectious illness or of an operation. The origin of an embolus, however, cannot always be pointed out. Often these patients have had or have circulatory decompensation. The signs of an embolus go far wider than its aforementioned symptoms. When the symptoms do not set in so quickly, the differential diagnosis is more difficult. In the case of an arterial thrombus, the patient has often had precursory symptoms for a long time, even for years—sensation of cold and numbness, neuralgic or rheumatic pain in the extremity, and circulatory disturbance with cyanosis in the peripheral parts of the extremity. Further, it must, of course, be taken into consideration whether arteriosclerosis be present. It is true, the proof of arteriosclerosis is not decisive and does not preclude embolus. Mistakes have occurred in distinguishing between a developing thrombus and an embolus. With a thrombus in the vein, the extremity is warm, cyanotic, swollen; as a rule the pulse is perceptible and the sensibility unchanged; and usually the thrombosing vein feels distressingly tender. With an embolus, the extremity is cold, generally pale, the sensibility is partially or completely suspended, and the pulse is imperceptible or very weak.

The thrombosing part can sometimes be palpated. When a thrombus originates before an embolus, the latter may be easily overlooked.

Local traumatic arterial thrombus. After trauma with slight internal injury, when the wall of the vessel is not ruptured, an arterial thrombus may appear in the injured place. As a rule, differential diagnosis in such a case is formed from the anamnesis.

With regard to an aortic embolus, a mistake might be made between hæmatomyelia and acute myelitis. One of my cases was sent to the hospital under the diagnosis, embolus medullæ spinalis. Embolus is characterized by pallor and cold about the legs as well as imperceptible or weak pulse.

LOCALIZATION

Many difficulties may be encountered in localizing a thrombus. As has already been shown, because of the collateral circulation, the circulatory disturbance will appear peripheral and only at a distance, greater or less, from the embolus. In many cases, therefore, it has been concluded that the embolus is seated still more peripheral. By taking into consideration that an embolus generally lodges at the division of an artery, and that it is seated more or less central to the boundary of the circulatory disturbance, and also by carefully observing where the pulse ceases or decreases in strength in the artery in question, one can generally succeed in localizing it. When observing the pulse, one must take into consideration that it may be difficult to detect it because of the patient's weak heart action.

INJURY TO THE INTIMA WITH CONSEQUENT THROMBUS BUILDING

After an embolus has been removed, a lesion of the intima in the part where an embolus has been situated, is likely to take place sooner or later which may cause fresh thrombus formation so that the vessel may become obstructed, and removal of the embolus will bring no benefit. There is no doubt that it would be difficult, if not impossible, to decide in any one case whether thrombus building arising after removal of an embolus is caused by a lesion of the intima or is the result of some mistake in technique. Even though the risk of the lesion, with its consequent tendency to thrombus building, increases with time from the outset of the embolus, yet the increase of the risk is not in direct proportion to the length of time;—but wide variations and peculiar exceptions are to be found, just as in secondary thrombus building.

Naturally, of great interest and practical importance is the question how long the blood stream through the chief arteries to an extremity can be suspended by an embolus without injuring the vitality of the tissue. As yet it is not known with exactitude how long the blood stream to an extremity can be obstructed without loss of vitality in the tissue. It is of general knowledge that, if one must bandage an extremity to stop hæmorrhage, for example with an Esmarch's bandage, one must not let it remain too long, or ischæmic contraction will take place; or, if the bandaging remains still longer, gangrene will appear. It is stated that ischæmic contraction may arise when the bandaging has lasted from 2 to 3 hours. In the matter of an embolus, the conditions are quite different. Here the arterial circulation is eventually suspended while the vein and lymph channels are not obstructed. Nor are the nerves exposed to pressure. Further, the embolus may happen not to be fully obturating until it becomes so by a secondary growth, so that the time when the symptoms set in, and the time of complete suspension of the flow of blood through the arteries do not coincide. In the case of an embolus, the collateral channels also play a part more or less, and the heart action and condition of the vessel walls are of considerable importance for the functioning of these. The patient's general condition and the vitality of the tissue (the patient's age) likewise play their part.

After the removal of the chief embolus, small emboli that have previously lodged further out in the peripheral arteries may hamper the circulation. Secondary thrombus building may obstruct important collateral channels, and in this way make the obstruction of circulation more complete than before the removal of the embolus. After its removal, if the thrombus formation has not also been completely taken away, more or less circula-

tory disturbance will be caused. Thus there are many factors which contribute to the result. No set time before gangrene occurs can be given; one must be prepared for great individual differences. The longest time that has passed between the appearance of the symptoms and embolectomy, without ischæmic necrosis or gangrene setting in, was 24 hours. Probably the circulation was not completely obstructed so long as that.

ANÆSTHETICS

In all my cases I have used local anæsthetics with novocaine and adrenalin solution, all of which received a complete and satisfactory anæsthesia. As these operations have to do with individuals of low physical tone, and generally of poor heart action, it is most important that the operation be carried through as carefully as possible. The risk of the operation is, no doubt, considerably less if it can be done with local anæsthetic. When operating on the relatively an easily accessible vessel, such as the arteria axillaris, brachialis, iliaca externa, femoralis or poplitea, one generally ought to manage with local anæsthetic. If, for the removal of an embolus in the aorta, or in the arteria iliaca communis, one must perform laparotomy, it will as a rule be necessary to use a narcotic.

TECHNIQUE

When performing embolectomy, it is of highest importance that the proper technique be used. The slightest mistake might cause thrombosing of the sutures, by which the good result of the operation might be lost.

As the technique for the suturing of vessels is nowadays well known, I shall not give an account of it. I myself have used Carrel's technique mostly, using very fine needles and very fine silk sterilized in vaseline. In my first cases, I covered the wound with vaseline compresses. When proceeding thus, the rubber gloves used during the operation become very slippery, which renders the sewing with fine needles considerably more difficult. On account of this, I have made a slight change in the technique since 1919. As sodium citrate prevents the blood coagulating, I have replaced the vaseline compresses with compresses dipped in 2 per cent solution of sodium citrate. The arteries have been surrounded with the same and the surface of wound covered with it. From the time when the vessel is opened, until the completion of the suturing, instruments and gloves are rinsed in 2 per cent sodium citrate solution. I consider this method of procedure good practice, and am well satisfied with it. The curettes or probes that are used for removing the embolus should be smeared with vaseline.

When the artery is laid bare, the operator satisfies himself of the position of the embolus and its extension above and below. Should it be uncovered in the wrong place—and the error of calculating lower down than the embolus often occurs—he has either to follow the artery until meeting with the embolus, or to expose it in another place. If, as is usually the case, the embolus has lodged at the division of an artery, he carefully attempts to isolate the vessel where it divides so that clamps may be put upon branches also. Should other branches of the artery lead from the area in which the embolus is situated, the most prudent method is to isolate these vessels as well, in so far as the vessel clamps can be used. When the artery has been surrounded with compresses dipped in sodium citrate solution, a weak vessel-clip is placed central to the embolus. Since the intima where the embolus is situated may easily become injured by it, and since it is best to perform arteriotomy upon an uninjured intima, one ought, if possible, to avoid arteriotomy at the place where the embolus is lodged, and to do it immediately above the embolus. If difficult or impossible to get sufficient room above the embolus, one may be obliged to incise the blood vessel at the part where it is situated. Sometimes it is better to incise below it. When the arteriotomy has taken place, the embolus may happen to fall away of itself or by a slight pressure on the vessel. Generally it must be lifted out, and this should be done exceedingly cautiously, with a fine pincette or a small blunt curette, in order that the intima may not be injured. At times the embolus is so fragile that it goes to pieces when taken hold of and has to be removed in many parts. When the embolus is long, or secondary

thrombus building is present, it may be difficult, or impossible, entirely to clear the vessel. It is of utmost importance that this be done as completely as possible. Should one not succeed in removing the central parts of the embolus or secondary thrombus, or when the embolus is of such a length that it cannot be extracted otherwise, one may, through an arteriotomy opening made below the locality, and with a blunt curette or with a sound, attempt to loosen the same and let the flow of blood wash away the pieces of the thrombus. It will sometimes be necessary to proceed in this way with an embolus in the upper part of the arteria axillaris and in the arteria subclavia.

The distal part of the iliaca externa can be easily exposed extraperitoneally under local anæsthesia. The inner part will be more difficult, particularly with stout persons. The arteria iliaca communis and bifurcatio aortæ are exposed most easily by laparotomy. This operation, which must generally be performed with a general anæsthetic, is nevertheless a great strain on these patients, who are mostly of poor physical tone. It is far less trying for them if one loosens the embolus with a blunt curette introduced through an incision in the arteria femoralis communis, and lets the flow of blood rinse it out. That an embolus in the bifurcatio aortæ can be advantageously removed in this way has been shown in one of my own cases. Suppose, however, an embolus be situated where the aorta divides, then the other side of the arteria femoralis communis ought to be exposed first and a vessel clamp placed here, so that the pieces of the embolus which are loosened and possibly flung out to this side may be stopped against the vessel clamp and easily taken out afterward. In a case of mine, a small embolus had lodged in the arteria femoralis communis division in the other leg, and was not discovered until the day after the operation. In order to attempt the removal of an embolus from the bifurcatio aortæ with retrograde probing, it would probably be necessary to do it from both sides. When possible to lay bare the part of the artery where the embolus is located and remove it straightway, this is clearly the most expedient method; but, with an embolus in the arteria iliaca communis or bifurcatio aortæ, such an operation is so severe that I consider the procedure I used in my own case, with the modifications I have here suggested, to be preferable as a rule.

After the embolus and possibly secondary peripheral thrombi are removed, vessel clamps should be placed so that the bleeding of the collaterals may not impede the sewing up of the wound in the vessel wall. These clamps should be placed peripherally to the arteriotomy opening, and on the vessel channels that lead from the opening; that is to say, between the part of the chief artery where the central and the peripheral vessel clamps have already been placed. As secondary thrombus building may arise centrally to an embolus, one should take off the central vessel clamps for a moment or two before sewing the vessel wall together. Thus any centrally placed thrombus, or remains of the embolus, can be flushed out by the stream of blood. During this flushing-out process, the peripheral vessel clamps must be in place, so that any possible parts of the embolus or the central thrombus may not flush into the peripheral parts of the vessel. When the embolus has been removed, the blood should be allowed to spurt out through the arteriotomy opening in a vigorous stream by intermittent jerks that synchronize with the pulse. Should the blood run only from the central end, we have an indication that the passage is not quite clear and that there is some obstacle above. This obstacle then must be cleared away, either by retrograde probing, or by laying the vessel bare higher up and making a fresh arteriotomy. Thrombi left in the peripheral arteries will cause circulatory disturbance more or less severe according to their extent.

As already stated, the embolus is often repeated, and two or more emboli within the chief artery frequently occur in the same extremity. It is therefore most important to direct special attention during the operation to the possibility of manifold emboli within the chief artery. If such be overlooked, the circulation will not be fully restored, and gangrene may set in. *After the embolus and the contingent secondary thrombus are removed and the vessel has been sewn together, investiga-*

tion must be made as to whether the circulation has been completely restored in the extremity. Should circulation not be restored, an examination must be made to discover whether more emboli are present, and according to the diagnosis thereupon, these also must be removed if possible.

Attempts have been made also by a bloodless method to remove the impediment in the circulation that an embolus gives rise to, by means of crushing it with massage. Some successful cases of this method have been described in literature. It is certainly not entirely a safe procedure to loosen an embolus by massage, as it might lodge in a fresh place and cause gangrene. This method ought to be wholly confined to cases of embolus, with threatening gangrene where arteriotomy is contra-indicated because of severe arteriosclerosis, weak heart action, or low physical condition, or where arteriotomy cannot be done because of local circumstances.

The prognosis for the possibility of preventing by embolectomy the occurrence of gangrene in connection with an embolus in the bifurcatio aortæ, the arteria iliaca communis, or in the chief artery of an extremity, depends very largely upon how soon after the appearance of the embolus the operation takes place. The sooner the operation, the better the prognosis. If, after considering the patient's general condition, the action of the heart and the condition of the vessel, an operation is indicated, then the prognosis for it during the first 10 hours is quite favorable, but will become less favorable very quickly after this period. Even when gangrene has begun to appear, a vessel may become permeable after embolectomy, and the condition of the circulation improve, with the result that the line of demarcation moves further peripherally.

END-RESULTS

In most cases, embolectomy has been performed on patients with some degree of organic heart disease. These patients may go through the operation, yet the origin of the trouble still remains, and they generally succumb to it sooner or later. Nevertheless, many have had relatively good health for a number of years, and could work more or less. Naturally the prospects of a lasting benefit are better in the cases where there has been no previous organic heart disease, but where the embolus appeared from another cause, as infection.

INDICATIONS

An embolus, which causes circulatory disturbance of a threatening character in the upper or lower extremities ought to be removed by arteriotomy unless there are contra-indications otherwise present. Moreover, the operation ought to take place as soon as possible. The localities chiefly affected in such cases are: bifurcatio aortæ, arteria femoralis communis, arteria iliaca communis, arteria poplitea, arteria axillaris and the upper part of arteria brachialis. Partly to avoid the risk of secondary thrombus building and partly not to incur a risk of injury to the intima, embolectomy ought, in my opinion, to come into consideration at an early stage, before the embolus in any of the above-named localities has produced threatening circulatory disturbance; so soon, indeed, as the symptoms are sufficiently clear for the diagnosis to be formed, and threatening symptoms need not be expected.

If gangrene has already begun to appear it may, in certain cases, be indicated that, through attempting to improve the circulation by embolectomy, the line of demarcation may move further peripherally, and thus a smaller section will require amputation.

As the embolus suitable for operation is far from rare, it is of moment that practising medical men learn to diagnose it in time, and that they immediately consult a surgeon or send the case to the surgical department of a hospital.

If, on account, of local circumstances, this cannot be done, or if the operation be contra-indicated because of the patient's general condition, the action of the heart, or the condition of the vessel, an attempt should be made in an early and suitable case, to crush the embolus by massage.

JOHN B. MURPHY ON SURGERY OF THE JOINTS[1]

By RAFFAELE BASTIANELLI, M.D., F.R.C.S.(Hon.), Rome, Italy

WHEN the Director General of the American College of Surgeons, in the name of the Board of Regents invited me two years ago to deliver the Murphy oration, I was obliged, much to my regret, to decline, on account of a previous engagement, and when the invitation was kindly repeated for this year I accepted it with pleasure, because I felt that through this great honor conferred not to my person but to my country even my humble voice could contribute to show the appreciation we have in Italy for American surgery and for the teachings of John B. Murphy.

In the course of time I realized how big a task I had undertaken and in thanking the Board of Regents, the Honorable President, and the Director General, I wish to express to all my deep gratitude for this invitation and my feelings of indebtedness to America, since from this country I have received many of the best impulses which can enhance a man's life.

I first heard of Dr. John B. Murphy when I read his contribution on the button devised by him. Soon afterward I had the pleasure of meeting him in Rome, at the International Congress of Medicine held in 1894. I remember him as a tall man, dressed in a long black frock, walking quickly through halls and corridors demonstrating this button. He carried with him rubber tubes in which skilfully and quickly he inserted it, and while pulling them apart and showing the firm reunion, he would conclude . . . "now your stomach and bowels are buttoned for good" and quickly disappear for the next demonstration.

He was accompanied by his beautiful and distinguished wife, of whom, on later occasions, I learned the high qualities and the importance that she had had in his career and in his welfare.

I will repeat only one episode he told me, that one night he, being extremely tired by the great daily work and not feeling well, was asked urgently to go and see a very severe case at a distance of some two hundred miles, and when Mrs. Murphy saw that his conscience was debating in the conflict between duty and the tired body, she ran to the telephone and asked for information. When she was told how desperate was the man's condition, so that Dr. Murphy's visit would be practically of no use, she offered to go herself instead of the doctor, saying to the astonished people: "Let me come, I will try to help you in his place." And she went and she found the man expiring, and she took care of the children, of the mourning wife, and of the burial, and when she left the house the family felt her help as true and as good as coming from a messenger sent by God. To such a woman I wish to offer my most deep remembrance and honor.

I have seen many times Dr. Murphy in his work and in his clinics and every time I could find a new progress of his mind and of his hands, and leaving him I felt as if his enthusiasm and his originality were permeating my mind, accompanying me, and working deeply on me as a spiritual provision long to last. Such was the influence of his strong personality as a surgeon and as a teacher. Of him spoke so well Sir Berkeley Moynihan, and I consider his oration such a just tribute to the man that it is unnecessary for me to speak further of his person.

The button made him famous in his youth and justly, for it gave a great impetus to intestinal surgery and even now though a good surgeon can rely upon infallible sutures, still it maintains favor among some. If it is just to say that for the majority of surgeons the button is a historical remembrance, it is equally just to say that the man who originated it rose higher and higher, for his judgment was above his work, and he could continually improve it, since he brought to it the scientific spirit and the broad conception which can make of a surgeon an artist, that is the man who creates, and not a mere artisan.

If we can say that when he was attacking a problem he did it always with a full scientific

[1]The third John B. Murphy Oration in Surgery, delivered before the Clinical Congress of American College of Surgeons, Boston, October 23, 1922.

and clinical preparation, we must say that for none did he do this so perfectly as for that of the bones and joints, and I believe that in none of the many questions with which his name is connected he has left such a deep and everlasting mark as in this, for what he taught then is almost exactly what we believe now, a very rare event in those quick days.

His investigations began in 1901 and in this year he performed his first arthroplastic operation. In the following year he gave a preliminary report and a demonstration of a case. From that time on, he constantly worked on this subject, as it appears from his publications, so that we may well say that he dedicated to it the last 15 years of his life.

If his main contribution in the surgery of joints is the treatment of ankylosis, I believe that it is no less worthy of merit that he developed a rational method of treatment to prevent ankylosis. Time and especially the late war have shown the good foundation on which his principles of treatment were laid, and while not all of the principles were original with him, nobody before the war so clearly and so forcibly impressed them upon the minds of the surgeons.

Do practitioners realize the great importance of such principles? If we were asked what is the ultimate fate of an articular infection, almost every one would answer that the result is the loss of function, if life and limb are not destroyed. We must fight this opinion most strenuously, as the surgeon who believes thus is like the general who believes he will lose the battle. Let us say instead that the aim of treating lesions of joints is to preserve function and if certain rules are followed it is possible to do this in a great many more instances than is believed generally.

How deeply John B. Murphy was impressed with this fact is shown by the attention he repeatedly paid to this argument in his lectures and by his efforts to develop this theory not only along practical but scientific lines. He believed that inflammations of the joints were of metastatic origin, and that especially the so-called rheumatic affections originated as a rule from a primary infection of a mucous membrane. He tried to establish the exact time of occurrence of the metastases for each kind of infection. In this way better than by reasoning, he could help to show that trauma, chills, wet weather, etc., were only occasional causes of arthritis. Every one will agree with him on these points, even though they do not agree with him as to the ability to determine the exact time of incidence of the metastasis.

The anatomical and physiological conditions present in a joint when infection develops have been clearly described by him, and he was able to show by practical demonstration that distention of the synovial membrane by exudation must be promptly relieved, since early absorption and self-defense of the joint are seldom possible. He stressed the opinion that opening or draining a joint was very dangerous, while puncture, aspiration, and formolglycerin injections would be productive of favorable results as far as function is concerned. And this was the lesson that the war taught us later. We all agree now how dangerous it is to keep open, to drain, and especially to plug a joint. We agree that even bad wounds can be cured with very good functional results if the surface infection is dealt with by extensive removal of all the tissues involved by the lesion and if the joint is hermetically sealed by suture. At the present time, however, we may not hope to master the infection in every case, especially when it assumes the severe form of capsulosynovial phlegmon, for in such cases the question of preservation of life and limb generally arises and radical measures must be instituted.

The next important principle he insisted upon was not only the well-accepted one to prevent bad position of the joint, but also to avoid immobilization as a routine. Murphy was a warm upholder of this principle. He believed that muscular contraction was one of the most active factors in producing ankylosis as through such contraction the bone ends were pressed together and destroyed. This sequela can be avoided only by permanent traction. In that he was a follower of the great principle which originated in America. The damage produced by immobilization itself is worthy of great consideration; in

fact I feel that we are about to swing to the opposite point of view—that articular lesions should not be treated by immobilization even tuberculous lesions, although there are naturally exceptions. How revolutionary this is from the old teachings of Bonnet so long followed religiously all the world through! It seemed impossible at the beginning of the war to conceive that purulent arthritis could be treated by small openings, and by active mobilization, but now clinical experience has shown that mobilization according to Willems has stood the test of time.

There is much to be hoped for in the antiseptic treatment of joint infections by means of the new deep germicidal substances, for instance the derivatives from quinine and from aniline dyes.

Autogenous vaccine therapy also holds a prominent place in joint treatment according to Murphy. Today we are far from believing in a specific action produced by such therapy, and the tendency is growing toward the principle that the results obtained are due to the reaction of the body tissues to a non-specific stimulus. We are coming back to the old venerable tradition of nature-healing efforts.

The doctrine of healing inflammation and of the healing fever has had no greater exponent than Professor Bier, whose teleological principles applied to the treatment of acute or chronic infections are worthy of much consideration. However, his treatment with passive hyperæmia has not found favor among the practitioners, owing especially to technical difficulties, and so it has disappeared except in a few German clinics. Some 20 years ago he proposed the injection of foreign blood in treating gonorrhœal arthritis, as he wanted to activate the healing tendencies of the body through a general stimulus given by a foreign protein. According to his views and to the ones lately developed by others, we have come to believe that all the remedies at our disposition work in the same way—that is, they increase the power of healing inflammation. It does not make much difference in principle if these remedies are vaccines, specific or non-specific, or protein substances, or antiseptics, or physical agents. We may call this therapy proteintherapy, or since the same results have been obtained with inorganic chemical products, we may call it activation of the protoplasm as suggested by Weichardt, or we may call it as does Zimmer, the threshold stimulus therapy (*Schwellenreiz Therapie*).

Leaving aside the theoretical problems involved in such a question, one thing is certain and that is that these substances produce in the tissues a destruction of cellular elements and their products made free produce an increase in the cellular activity against the disease. You are all familiar with the researches made in this country and in Germany on this subject and with the results obtained. You have heard of the remedies they call sanathrit, kasein, and yatren kasein. The last according to Zimmer is giving the best results as it is easy to administer. He claims to have cured promptly gonorrhœal arthritis, acute shoulder arthritis, chronic arthritis, arthritis deformans, rheumatic pains, and neuralgia. Let us hope that such a miraculous therapy is a real one.

Whatever we may do, however, ankylosis will never be completely eliminated. To the treatment of ankylosis John B. Murphy gave the greatest impetus and his views, although having had some few predecessors, can be justly called his own.

The idea of restoring movement to a stiff joint by a cutting operation was not a new one. J. Rhea Barton, of Philadelphia, in 1826 performed the first osteotomy through the great trochanter to obtain a pseudarthrosis and mobility of the hip joint which was in a very bad position. It is very interesting and almost pathetic to read of his plans and his hopes. "I do believe," he says, "that nature would not possibly witness my labors to effect what she has so often herself endeavored, unaided by art, to establish, but that she would be ready to co-operate with me in the formation of a new and useful joint, as a substitute for the one which disease has annihilated." But nature did not answer this invocation and after a few years the joint was ankylosed. He planned also to extend the use of osteotomy to the knee, shoulder, elbow (for which he sketched an angular resection), to the big toe, and to the jaw, "performing the operation through the

original point or so near to it that the use of most of the tendons and muscles would not be lost, and where the deformity or inconvenience was such as would induce the patient to endure the pain and incur the risk of an operation."

Could we express in better words today the indications for arthroplasty? It was not a new idea that the interposition of tissue between two bone ends could produce a pseudarthrosis. It would be easy but long and tedious to present to you the historical development of the question. I will say only this, that notwithstanding that principles were known and some operations had been performed they were rather attempts, and when Murphy entered this field of endeavor the profession was very loath to accept his theory that the real treatment of ankylosis, even if the parts were in good position, should be mobilization. Murphy looked at the problem from a general viewpoint, studied it experimentally, and gave the details for properly performing the operation upon every joint. He also introduced a new theory that the fat and fascial flap would be changed by articular function into a kind of hygroma and would form the articular space. The profession accepted his teaching but slowly and only recently has it been possible to study the results obtained by some few men who entered the field, as Baer in this country; Putti in Italy; Payr, Hoffa, Bier, and others in Germany.

The substitution of free flap transplantation—periosteum, fat, or fascia—was a decided advance. Foreign bodies have all been discarded but Baer's membrane to which the author is faithful and may be with reason.

And further progress is perhaps to be found in the proposition that a new joint can just as well remain movable even without flap transplantation and without resorting to extensive excision. Schmerz and Schepelmann have demonstrated this fact clinically and experimentally, Schmerz emphasizing the importance of a complete fine polishing, with files, of the bone ends, and Schepelmann especially permanent extension and function to which he gives all credit.

This theory seems to me well supported by embryological facts, by a study of the old experience in joint excision, and by experimental and clinical study of the transplanted flaps. Let us consider this question briefly. The experiments and the interpretations do not agree. One theory is that there is a complete substitution of the flap by new tissue, while another theory is that the flaps heal and undergo a transformation either into connective tissue or into a sort of hygromatous tissue. Others believe that the flaps are a danger to mobility through adhesions and only when they disappear can mobility be obtained.

Also the anatomical investigation of tissues removed at operation has not always disclosed the same findings. Every one admits that the bone surfaces are covered by a connective tissue, which is smooth and more or less hard and flattened where there is friction and pressure. Putti found that a fascial flap after 3 years was transformed into a connective tissue with a cartilaginous new formation. Lexer found, healed and intact as when grafted, a flap of fat which had been transplanted into a hip joint, because of dislocation of the femur and non-use of the limb. It seems to me that even granting the possibility that the flap may remain vital to a certain extent, I think that it does not influence the mobility of the new joint simply because of its presence, but because it regulates the proliferation of tissue. In cases in which the Baer membrane or fat flap is used the general law as applicable to every graft holds true, that a substitution of new tissue from the guest takes place. In cases in which fascial flaps are used I believe they act as a frame along which new tissue will grow. While the superficial layer is destined to disappear quickly, the deep layer in contact with the bone heals totally or partially, but finally and later is replaced by new-growth. However, as this layer is not dead material, it does not produce irritation; consequently the new tissue proliferation is limited within its boundary and the flaps then act as regulators of growth.

If the function of the new joint is active the result seems to be the same, whether the Baer membrane, the fat, or the fascial flap is used. But most important is the fact that a similar result can be obtained without

interposition, and Schmerz has described anatomical specimens from man which have the same structural character of connective tissue and of chondroid tissue as in the case of flap grafts.

Are we to expect that arthroplasty will soon follow the fatal stages of every new operation?

From the first stage of simplicity an operation goes through a second stage of so-called perfectionizing which is generally one of complexity to come back, after experience and disillusion, to a third one much nearer to the starting point.

So we will probably finally come to believe that the only salvation is not in flap transplants, but that the old time-honored resection, if properly accomplished and if followed by permanent extension, by proper changes of postoperative position, and by active movements, will perhaps yield satisfactory results in most cases. Certainly this is true in dealing with affections of the jaw, of the elbow, and perhaps also with those of the shoulder and hip. For the knee, however, experience is too limited and it is better to give the patient the full benefit of the doubt and place a thin fascial flap on each bone surface.

Even if the principle of flap interposition should later be discarded, and it does not seem that this will happen, it has been most fruitful just as so many other working hypotheses have been in other lines, in promoting joint surgery and bringing about the practical conclusions. It has helped to extend the benefits of such operations in many other disabling conditions of joints and its use may possibly be extended to include tuberculous cases.

This is still a difficult question and scarcely studied by surgeons. Especially today when current opinion is for conservative treatment in tuberculous cases, it will seem rather hazardous to present the possibility of mobilizing the joints, but I hope to have some few sympathizers among you, who believe as I do that extremely conservative measures are just as bad as extremely radical ones. Certainly sun treatment, X-rays, sea and mountain treatment, and iodine injections can do wonderful things. A. Bier claimed that even in the plain, with sun or artificial light, with passive hyperæmia and with large doses of iodide of sodium he could cure every case with but extraordinarily few exceptions. I am very loath to doubt other people's results, but if Bier is able to secure such results it has not been possible in other hands. And what can we say of sun treatment if Swiss surgeons say that notwithstanding their sun and their mountains, they must still resort to operative measures (Hotz)?

For the poor classes, I maintain that the operative treatment can be resorted to oftener and that such treatment will secure beautiful results if the operation is done by an experienced surgeon who can execute a really radical excision and who believes in the principle of never draining except in the presence of sepsis, and who can personally watch and supervise the after-treatment.

I beg of you to consider for a while that in tuberculosis of the elbow, excision of the joint gives a high percentage of cures with mobility, that a good percentage of mobility is obtained in the shoulder joint, and that the knee-joint excision followed by ankylosis almost invariably cures every case, with primary reunion and without recurrence.

If such are the results, that is if excision really removes all the tuberculous tissue why should we not aim to give to the patient a movable joint?

Present clinical experience is against such an idea, but the lack of success, as I must confess to have seen in many cases, does not in my opinion alter the soundness of the principle. It is a question still of its practical application. I believe that in such cases flap interposition should not be tried. The bone surfaces should be carefully burned with cautery and a fine film of iodoform either spread over them and the joint re-united by first intention without drain, or drained only for a very short time. For the after-treatment I believe that complete immobility for 2 weeks in extension is the best procedure, slowly proceeding with active and passive movements and changing the position of the limb, continuing extension for a long time if needed. Some possible limited recurrences can be well cured by iodoform, iodine, or carbolic injections.

Let me finally remind you that John B. Murphy wrote in 1904 thus: "In a large percentage of cases in which I formerly did an excision I now feel that the bony destruction was of such mild degree that an interposition arthroplasty might have been performed and the motion in the joint restored."

We are still far from reaching this ideal but I feel convinced that in properly selected cases it must be our final aim.

I would like to go a little deeper into the question of arthroplasty and to consider its indications, technique, and the end-results, and to compare such results with those of transplantation of joints and of cartilage, operations exceptionally used and which should perhaps be abandoned. But a field of such magnitude can be discussed only from a general point of view in an oration such as this, as details are apt to be tedious and certainly are of interest only to a few specialists.

I will say only that the final results in arthroplasty have not been uniformly satisfactory. The results are good in perhaps only 50 per cent of all joint cases. In the treatment of ankylosis of the knee, which should be the proof of the value of the method, mobility and stability have been secured only by a few operators in a good proportion of cases, while the majority have secured results which are poor—15 per cent according to the statistics collected by Henderson. I believe that such results are due especially to the fact that the question has been attacked chiefly in regard to the bone and to the interposition. But the knee has such an important and powerful muscular extension apparatus and the flexion is so intimately connected with its capability to resume its function that unless we have these factors in mind results will not be favorable. The condition of the superior articular pocket and its intimate relation with the intermediary portion of the rectus muscle, are factors of such importance and insufficiently looked for, that it is no wonder if results are not uniformly good. Moreover the condition of the new scar tissue forming around the joint and how much the failures are due to it are not well known.

Perhaps we may expect that future or postoperative treatment consisting in local injections of substances preventing pain, or of something capable of inducing softening in the connective tissues and formation of hygromatous cavities or of substances capable of digesting and re-absorbing scar tissue may be of the greatest importance. I will mention only the intra-articular and peri-articular injection of blood, blood serum, gelatine, salt solution, used by Bier and a novocaine pepsin iodine colloid solution used by Payr.

May we hope that the new deep, germicidal, chemical substances combating successfully joint infection, that the cellular stimulant working on acute and chronic cases, and that the therapy used to produce digestion and resorption of the scar tissue will bring about a revolution in joint surgery.

Certainly this field is enormous and we are working in the right direction in trying to prevent and to perfect operative technique in dealing with these joint lesions.

You will excuse me for having touched only upon these few points; to do more would have been impossible when one considers the many biological, physiological, and pathological possibilities of the joints.

I would feel very well satisfied if I have succeeded in awakening an interest of some in these questions. I hope I have reached the goal I sought in paying a tribute of admiration to John B. Murphy as a pioneer worker in this field as he was in many others, and in so doing if I have been able to present adequately not only what he did but what he made others do and if I have made you feel that his powerful personality, his dynamic influence are still dominating and inspiring men who are working along the paths he has opened to investigation.

A COMPARATIVE STUDY OF TWO SERIES OF GALL-BLADDER LESIONS[1]

By JOHN G. CLARK, M.D., F.A.C.S., Philadelphia

NOW that the primary mortality of standardized operations has almost reached that irreducible minimum which Maurice Richardson has so well said would never wholly be eliminated, we have all turned more intensively toward the investigation of the vital traceries which are made by our patients after they are discharged from the hospital.[2]

The laboratory is a never-ending source of medical uplift, but investigations within this domain take chiefly into account the past and present status of the patient. A great improvement in health or a restoration to full-working capacity is, however, of decisive interest to the surgeon and to the patient, for this is the final test of the real value of surgical intervention. In my Clinic we have all experienced the value of this study of massed statistics, and without this striking of the balance sheet, a real menace to truth may be masked by such expressions as "it is my opinion" or "according to my experience," etc. Even with carefully digested data as a basis for statistics, decided errors may still creep in unawares. At a previous meeting of the American Gynecological Society, I reported a series of 159 cases of cholelithiasis and cholecystitis.[3] In this series the proportion of cholecystostomies to cholecystectomies was in the approximate ratio of two to one. Since then 159 additional cases have been operated upon, and the relationship between these two operations has almost exactly been reversed.

It has been interesting to ascertain the underlying motive for this revolution. One might accredit it to a national change in surgical modes, and certainly this assumption has a very considerable basis in fact, for it is rare indeed to find a surgeon so adamantine in his views that he is not influenced by collective professional opinion. At approximately the time when our first series was published, a general impression obtained in most American clinics that even a well-executed cholecystostomy as a healing agent was not so efficient as had been anticipated. The primary mortality was not high, but the subsequent morbidity was such as to cast a shadow upon its unqualified value as a wholesale measure. As we analyzed our unsatisfactory results in this first series, the errors were ascribed to two sources: first, a failure to remove a number of irretrievably diseased gall bladders, and second, to the postoperative sequelæ, which may result from adhesions around the tract of any intraperitoneal drain. Unquestionably, too, we were influenced by the misleading thought that a cholecystostomy was a less perilous, and, therefore, a more conservative operation so far as immediate mortality was concerned. In the development of the technique of cholecystectomy this assumption has proven erroneous, for it is actually less dangerous and certainly is followed by a better immediate convalescence. It was, therefore, without trepidation so far as this hazard was concerned that we turned from the first to the second measure. It now remains to be seen whether the extirpation of the gall bladder carries in its remoter train of events disabling consequences, which may again bring these two procedures to nearer an equal ratio.

In our original series we discussed these cases under three headings: operations for cholelithiasis and cholecystitis; second, operations for more than one condition, the cholelithiasis or cholecystitis, with definite symptoms, being a coincident part of the combined operation; and a third class, in which a cholelithiasis was found as a mere incident of a routine intra-abdominal examination at the time of another operation, but unattended with any subjective symptoms.

In a few of the earlier of these cases the gall bladder was stitched to the ventral peritoneum

[2] American surgeons are under deep obligations to Dr. Emery Codman for his crusader-like insistence upon the vital necessity for a complete trial balance of remote surgical results.

[3] Ultimate results secured from surgical intervention in simple cases of cholelithiasis and in cholelithiasis discovered during operations for other conditions. Am. J. M. Sc., 1914, November.

[1] Presented before the American Gynecological Society, Washington, May 1-3, 1922.

TABLE I.—COMPARATIVE STATEMENT OF SIMPLE AND COMBINED GALL-BLADDER OPERATIONS PRIOR TO 1914

By Frank B. Block, M.D., Philadelphia

	Per cent Simple gall-bladder operations	Per cent Combined operations with gall-bladder symptoms	Per cent Combined operations without gall-bladder symptoms	Per cent Total
Number of cases	55	73	31	159
Percentage of cases traced	84	78	86	86
Average age of patients	42	39	44	41.7
Average number of days in hospital	29.4	28.6	29	29
Complications of convalescence				
Infection	5.9	9	9.7	8.2
Prolonged vomiting	0	4	6.4	3.1
Phlebitis	2.0	2.6	3.2	2.5
Pneumonia	0	1.3	0	.6
Returned for second operation	0	9.5	0	4.4
Postoperative history				
Cured	69.5	59.7	64	63.8
Great improvement	15.2	17.5	16	16.1
Slight improvement	0	1.7	4	1.5
Unimproved	2.1	8.7	0	4.6
Worse	0	0	8	1.5
Died in hospital	(Combined mortality)		0	4.6

TABLE II.—COMPARATIVE STATEMENT OF SIMPLE AND COMBINED GALL-BLADDER OPERATIONS, SERIES FROM 1914 TO 1922

By Charles A. Behney, M.D., Philadelphia

	Per cent Simple gall-bladder operations	Per cent Combined operations with gall-bladder symptoms	Per cent Combined operations without gall-bladder symptoms	Per cent Total
Number of cases	62	79	18	159
Percentage of cases traced	96	90	95	94
Average number of days in hospital	25.8	26.6	23.5	26.3
Complications of convalescence				
Infection	0	7.6	5.5	4.4
Prolonged vomiting	4.8	2.5	0	3.2
Phlebitis	3.2	2.6	0	2.2
Pneumonia	1.6	3.8	0	2.2
Postoperative history				
Cured	65.3	67.2	94.1	69.9
Marked improvement	8.2	16.4	0	11.3
Slight improvement	20.1	7.5	5.9	12.0
Unimproved	6.2	8.9	0	6.8
Worse	0	0	0	0
Returned for second operation	3.2	10.1	0	7.4
Died in hospital	(Combined mortality)		0	3.7

One case re-operated upon in another hospital.

and drained. Experience soon demonstrated the fallacy of this procedure, for not infrequently fistulæ persisted to a disheartening longevity and the patient was annoyed by more or less pain at the point of suspension of the gall bladder. This method, therefore, fell into disrepute and instead the gall bladder was drained *in situ* with a special inset tube and an immediate betterment of postoperative tugging pains was noted. The days in the hospital were materially reduced on an average in all three subdivisions above noted from 33 to 25 days, with a material benefit in every way. Now that the morale of the patient as a health-promoting factor is having such just consideration, we appreciate the fact that every postoperative annoyance eliminated is a big stepping stone toward a cure. With our present technique, the gall-bladder drainage practically always ceases within a day or so after the tube is withdrawn. Even under these more favoring conditions, there still remains a definite percentage of patients who complain of pain in the biliary region, which was not an ante-operative symptom and unquestionably emanates from adhesions which hinder the action of the gall bladder, or cause distress in adjacent viscera. By the patient this symptom is often designated under the all-inclusive expression, "indigestion."

In this series of 159 cases, there were six deaths—one from cholæmia due to an extensive destruction of the pancreas, the second from cholæmia in a case of an associated operation for a large incarcerated umbilical hernia in a very stout patient, and a third from cholangeitis and pancreatitis, in which a stone was imbedded in the pancreas and was not found until autopsy. The fourth was from a gradual failure in an advanced case of pancreatitis induced by cholelithiasis, the fifth from peritonitis in an associated hysterectomy for chronic metritis, and the sixth from a subphrenic abscess due to leakage of the drainage tube. In four of these cases death was due to the hopelessly destructive results incident to a long-standing cholelithiasis, an irreducible minimum as designated by Richardson. The other two fatalities may be considered as of the preventable type.

In analyzing our statistics we find 118 cholecystostomies and 41 cholecystectomies in this first series. There were four postoperative fatalities among the 118 cholecystostomies including the combined operations, and two among the 41 cholecystectomies. As the result of our follow-up letters and through personal consultations, we were able to trace 85 per cent of these patients. Among these 118 cholecystostomies, of which 95 were traced, there were 64 complete cures, 6 were markedly improved, 11 slightly benefited, and 12 were

TABLE III.—COMPARATIVE STUDY OF CASES PRIOR TO 1914
By Frank B. Block, M.D., Philadelphia

	Per cent Simple gall-bladder operations	Per cent Combined operations with gall-bladder symptoms	Per cent Combined operations without gall-bladder symptoms	Per cent Total
Average days in hospital				
Cholecystectomy	27.9	29.6	24	28.3
Cholecystostomy	28.9	29.1	28.6	28.9
Cures				
Cholecystectomy	15	7	2	74.2
Cholecystostomy	23	30	17	73.6
Marked improvement				
Cholecystectomy	4	3	0	19.3
Cholecystostomy	1	7	3	12.1
Slight improvement				
Cholecystectomy	0	0	0	0
Cholecystostomy	2	3	0	5.5
No improvement				
Cholecystectomy	0	1	2	6.5
Cholecystostomy	0	8	1	7.7
Died				
Cholecystectomy	1	1	0	5
Cholecystostomy	1	0	0	4.5
Returned for operation				
Cholecystectomy	0	1	0	2.5
Cholecystostomy	0	7	0	6.4

Two cases re-operated upon were done in other clinics.

Symptoms present in 104 cases	Cases	Percentage
Indigestion	57	54.7
Pain	93	89.4
Jaundice	36	34.6

TABLE IV.—COMPARATIVE RESULTS OF CHOLECYSTECTOMY AND CHOLECYSTOSTOMY, SERIES FROM 1914 TO 1922
By Charles A. Behney, M.D., Philadelphia

	Per cent Simple gall-bladder operations	Per cent Combined operations with gall-bladder symptoms	Per cent Combined operations without gall-bladder symptoms	Per cent Total
Average days in hospital				
Cholecystectomy	25.9	27.4	23.6	26.3
Cholecystostomy	25.2	24.8	23.5	24.3
Cures				
Cholecystectomy	75.7	79.5	100.0	80.2
Cholecystostomy	33.3	43.5	85.7	47.6
Marked improvement				
Cholecystectomy	6.4	9.1	0	6.6
Cholecystostomy	16.6	30.4	0	21.4
Slight improvement				
Cholecystectomy	16.2	6.8	0	11.0
Cholecystostomy	25.0	8.7	14.3	14.3
No improvement				
Cholecystectomy	0	4.5	0	2.2
Cholecystostomy	25.0	17.4	0	16.6
Died				
Cholecystectomy }	(Combined mortality)			4.6
Cholecystostomy }				1.9

Symptomatology	Percentage
Indigestion	90.4
Pain	78.4
Jaundice	23.2

in no way helped. Of the unimproved cases, 7 were subsequently subjected to cholecystectomies, and 2 were re-operated upon for adhesions in the upper abdomen. There were 41 cases in which cholecystectomy was performed with the following results: not traced, 4; surgical deaths, 2; cured, 21; marked improvement, 2; improved, 6; and no improvement, 5.

Behind these bald statements as to results, there is much of statistical interest, such as the immediate convalescence of the patient, etc. In general we may state without reservation that the postoperative complications in the cholecystectomized patients were less in evidence and the patients were far more comfortable than were those in whom biliary drainage was maintained for 10 days. This was manifestly due to the fact that, at most, only a small cigarette rubber drain was employed and this was usually carried through a peritonealized channel in the groove of the liver to the site of the cystic excision.

Furthermore, as we reviewed these two series of cases we gained the impression, as so many surgeons have, that the interest of the patient is fostered by a more frequent resort to cholecystectomy, and as will be seen in a review of the operations which were performed after 1914, this revised policy was carried out so much more frequently that the ratio of cholecystectomies to cholecystostomies, which was two to one in the above series, was reversed. It will be of interest, therefore, to compare the follow-up studies in the two series. With the methods of drainage which we now employ (Figs. 3 and 4), the biliary fistula almost immediately closes upon the withdrawal of the tube and the stay of the patient in the hospital is consequently shortened. We may say, therefore, that this method of drainage in keeping the gall bladder empty without any contamination of the peritoneum is most satisfactory; nevertheless any foreign body which remains in the abdominal cavity from 5 to 10 days even though its contact with peritoneal surfaces is slight, will inevitably cause adhesions. While the adventitious peritoneal bands and web-like adhesions cause no subsequent discomfort, or they are at most of a fleeting character, in a large percentage of cases, in a smaller ratio very annoying and even seriously threatening or disabling complications may arise. From this standpoint, therefore, a cholecystectomy has a decided advantage. The convalescence, so far as the healing of the wound, the absence of an annoying drainage tube, a lessened frequency of postoperative adhesions, and a lower mortality, points more favorably

to a cholecystectomy as the method of choice, but does the remoter course of these cases sustain this operative preference? Because a cholecystostomy in the past has been considered less hazardous than a cholecystectomy, we may for convenience of comparison designate the foregoing series as the conservative, and the series now to be reviewed as the radical, although in the light of our present knowledge we realize that this is a misleading differential caption.

THE MORE RADICAL SERIES

The returns from our follow-up system show that 94 per cent of cases have been traced. It is a remarkable coincidence, and not by design, that the tabulated cases in this series were identical with the foregoing, viz., 159. Of this number there were 108 cholecystectomies and 51 cholecystostomies, a reversal of the previous ratio of two to one. There were five deaths among the entire number.

As the question of the fatalities is a most important point, it will be of interest to analyze the lethal causes with a view to ascertaining which may be classed as properly belonging to the irreducible minimum. The first occurred in an aged woman with a chronically inflamed and greatly shrunken gall bladder, with adjacent adhesions causing an obstruction of the pylorus. On removing the gall bladder it was found to be malignant. A posterior gastro-enterostomy was performed for the temporary relief of the pyloric obstruction. Death followed within a few days from an obstructive jaundice and cholæmia. The second occurred in a frail woman, a bedridden invalid for more than a year. The gall bladder was the seat of a chronic cholecystitis of an interstitial type, and it was also much shrunken, but the operation was very easy and uncomplicated. One hæmorrhoid was ligated and excised. Death occurred on the fifth day from pneumonia. The third death occurred in a patient upon whom a cholecystectomy had been performed for cholelithiasis and chronic appendicitis. A day before the expected discharge of the patient from the hospital after an uncomplicated convalescence, the lethal exitus came from a pulmonary embolus. The fourth fatality was caused by peritonitis after an operation for a simple dermoid cyst with coincident cholelithiasis. At autopsy the common gall duct was found to be dilated and contained a considerable accumulation of fine sand, which, however, did not block the channel. The pathologist was unable to ascertain the source of the peritoneal invasion. The fifth patient succumbed on the eighth day, after an uncomplicated hysterectomy for a myoma and a cholecystectomy. During the immediate convalescence there was no sign of danger. The temperature and pulse tracings ran a very satisfactory course until the eighth day when the patient was seized with severe pain in the splenic area and died within 6 hours. Upon autopsy the general peritoneal cavity was found free from evidences of peritonitis and death had occurred from the rupture of a subsplenic abscess. The surgical fields were quite normal. Sections of the spleen showed it to be the seat of an extensive chronic splenitis. As to the source of this infection, the pathologist could offer no explanation.

Viewed from the critical standpoint, one of the patients was irretrievably lost before she reached the operating table, as no measure can rescue a patient suffering with carcinoma of the common duct. Thus far no method of treatment can divert the occasional shaft which kills through pneumonia and embolus. We have, therefore, in this list of fatalities only two which might have been circumvented, both of which we count as surgical infections. The total mortality for the straight and combined operations was 3.7 per cent—were we to throw out of account the case of carcinoma of the common duct with ante-operative gastric dilatation, the mortality would be only 2.5 per cent. It will thus be seen that even when some other operation is a coincident part of a gall-bladder operation, the mortality is still within satisfactory bounds. However, we are particularly careful in our restriction as to these combined operations. In several cases in which there have been no preceding symptoms of cystic involvement, gall stones were discovered during the course of the general intra-abdominal examination but no intervention in this direction was attempted because the patient's con-

dition was not wholly satisfactory and an extra risk should never be run in such cases, for a second operation may be held in abeyance until the symptoms necessitate or the patient under advice chooses to have the stones removed at a more propitious time. Even in the presence of well-defined symptoms in the upper abdomen, if the lesion in the lower abdomen is of an infectious character, we intermit the manual exploration of the suspected locality. As to the stay in the hospital of this series, in general it has been lessened. Our statistics show an average decrease of three days. Were we to have struck the average of 158 cases it would have been still two days shortened for the one hundred and fifty-ninth patient suffered with a prolonged bronchopneumonia and remained in the hospital over 3 months. The wound infection, which was 8.2 per cent in the first series, dropped to 4.4 per cent in the second. Phlebitis in one series was 2.5 per cent in the first, and 2.2 per cent in the second. As will be seen in the comparative statistical table which shows several other details of convalescence, the results in the second excel those of the first. As to positive cures of the entire series, the results are about the same. When it comes to the relative difference between the qualified improvements and the unimproved, our statistics are distinctly in favor of the cholecystectomized patient. In other words, it would appear that the total removal of the gall bladder might be extended to still a larger percentage of cases. We hesitate, however, to make this suggestion, for we feel convinced that the probability of improvement lies in lessening the number of drainage cases, and we are in full accord with Willis and others who advocate this reduction on a well-grounded statistical basis. In symptomless cases of cholelithiasis, we are substituting the ideal operation. In such cases a cholecystectomy with closure of the gall bladder is a highly satisfactory procedure, and likewise when the gall bladder is diseased an uncomplicated cystectomy is equally safe without drainage. An increase in the number of cures will, therefore, in our opinion be facilitated greatly by less drainage, for the untoward symptoms which throw discredit upon gall-bladder surgery is largely to be credited to this error. Finally, at least a 10 per cent margin must be left which will include the unimproved class. In this discard will be found cases in which the results of the biliary, pancreatic, and gastric disturbances are so advanced when any operation is performed that they are really beyond the possibility of relief by surgery.

Fig. 1. The gall bladder is drawn up into easy accessibility through gentle traction with Allis forceps and an opening is made with scissors. Before this step is attempted the greatest care must be observed in protecting the peritoneum, with gauze packs, from possible contamination.

As we have studied the chronic cases, the same surgical cry arises as in many other diseases amenable to the benefits of any early operation, for we so often find that the uncured patients are among those who have suffered repeated attacks running over years. All too frequently they have passed the surgical boundary, because they no longer suffer solely from disease of the gall bladder but from a chronic infection of the biliary and pancreatic systems, with the extracystic anatomy so changed that no means will restore it, hence a persistently disabling or mortal disturbance of function will continue after any operation. Too often the attacks which may be far apart, with only moderate symptoms of indigestion in the interim, are treated tenta-

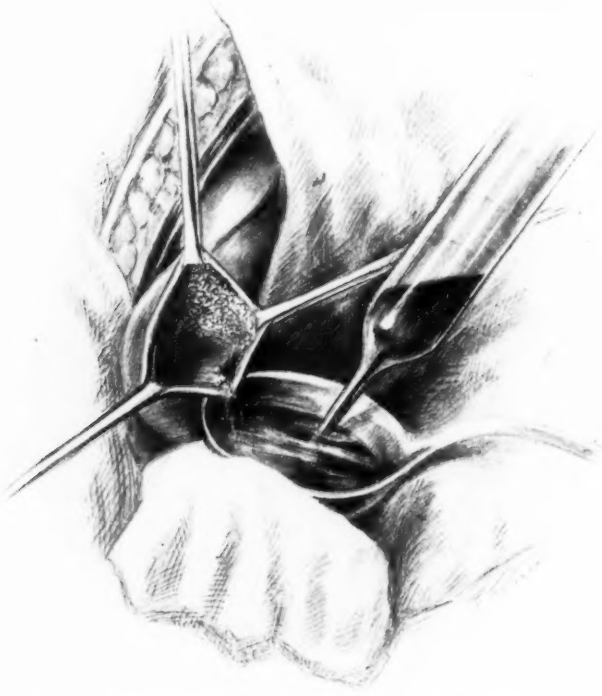


Fig. 2. Biliary spoon adjusted so that the bile flows easily into it. At the same time an assistant keeps the spoon evacuated with a syringe so that there shall be no overflow. The interior of the gall bladder is open to complete inspection and gross changes are at once detected, thus rendering easy a decision for or against cholecystectomy.

tively until an operation ceases to be elective and becomes immediately urgent. To illustrate this point, I again quote Richardson, who compared the quiescent gall bladder containing gall stones, to the phlegmatic old farm horse which placidly jogs down the country road month in and month out, oblivious to all scares in the roadway, but to the farmer's astonishment some trivial phantom causes him to run away with more or less tragic consequences. Never again can you trust that horse for he can no longer be designated as "Old Safety," for he will again run away. So with the quiescent cholelithiasis which finally precipitates a biliary colic; from that time on the patient's safety is so much jeopardized by recurring attacks that an operation becomes unequivocally indicated.

TECHNICAL POINTS

The use of a trocar for evacuation of the gall bladder has always been more or less unsatisfactory, because it not infrequently fails and even when successful the appearance of the cystic contents, unless actually purulent, gives but little real evidence of diagnostic value. Therefore, we bring the gall bladder well up into the field of vision through Moynihan's excellent method of hepatic rotation which is available in a large proportion of cases. Following Crile's suggestion a small patch is then excised from the dome of the gall bladder and its contents is emptied into a biliary spoon (Figs. 1 and 2), from which it is quickly withdrawn with a large glass syringe. By careful preliminary packing, the peritoneum will not be contaminated, and after the

Fig. 3. The drainage tube is held securely in gall bladder. To secure the most accurate water-tight closure, a Cushing stitch of fine Pagenstecher thread is used. Before the abdominal incision is closed, salt solution is gently injected into the gall bladder, thus testing the patulosity of the drainage tube, the security of the closure, and the washing out of small blood clots.

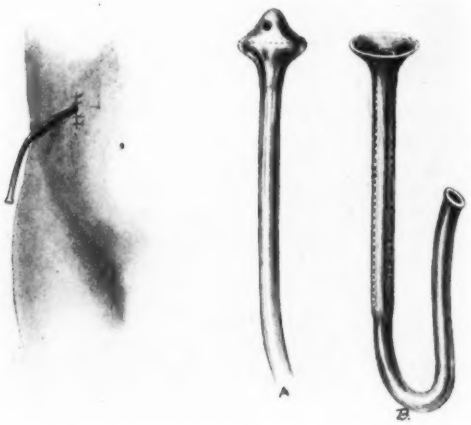


Fig. 4. The drainage tube is usually brought out through a stab wound. (a) A self-retaining vesical catheter is utilized in making the gall-bladder drain. The bulb is cut off along dotted lines, thus leaving a rubber flange which serves as a valve when the tube is sutured into the gall bladder. (b) A ductile metal tube is inserted into the catheter which keeps it rigid and free from kinking and yet permits a satisfactory adjustment to the abdominal wound.

gall bladder is thus emptied and the stones, if present, are extracted, its mucous membrane may be inspected. If of a strawberry type, or if it shows evidence of a chronic cystitis, ulceration, or atrophy, or there is great thinning from overdistention, it is removed. Only when it appears visually normal is it drained or closed by the ideal method. By this direct inspection, the possibility of error as to the necessity for a cholecystectomy is reduced to a minimum. In our experience, therefore, this evolution in diagnostic technique has been of real and positive value.

A second point as to drainage. The gall-bladder tubing must be so arranged that the incidence of postoperative adhesions is reduced to its lowest possibility. All too frequently in the past the drainage tract has been established through the primary abdominal incision. To obviate this error, which may incapacitate the gall bladder from proper functioning because of a bad anatomic position, not infrequently a second stab incision is made to the right at a convenient site, thus promoting drainage at a more dependent point. Furthermore if the gall bladder is drawn well away from the duodenum and pylorus, the gastric, duodenal, or biliary functions are subjected to much less postoperative disturbance in the event of adhesions.

As to the drainage tube (Figs. 3 and 4) we have utilized to great advantage a self-retaining vesical rubber catheter, which is protected against kinking by a specially constructed ductile metal tube, of sufficient length to conduct it through the incision, inserted to the bulb of the catheter. By the use of this very satisfactory arrangement, the drainage canal is rendered fully adjustable to the wound: a source of much greater comfort to the patient during the days of drainage. A stiff tube may be most distressing and a soft rubber one may

be the source of actual danger through kinking and blockage.

CONCLUSIONS

In the comparative study of the accompanying tables one may summarize the outstanding points as follows in favor of cholecystectomy. The postoperative convalescence is decidedly better, the percentage of cures is larger, the mortality is less, and surgical complications are in the minority. Against these advantages may be debited as a danger, the fact that should serious symptoms arise in the cholecystectomized patient which demands a subsequent operation, the opportunity for surgical alleviation is endangered through the absence of the gall bladder. Such operations are more difficult and dangerous, for anatomical orientation is greatly obscured. However, the possibility of a subsequent operation is minimized by the superior results following the removal of the gall bladder when its mucous membrane or mural integrity has been seriously impaired. Such gall bladders under the best of drainage do not tend to spontaneous repair, but frequently the same distressing trend of symptoms recur when the biliary fistula closes. Less drainage and more ideal operations when the gall bladder is intact, and more cholecystectomies and fewer cholecystostomies when it is diseased, would stand out as guiding principles if our observations have been correct.

The decision to subject a patient to an operation for a gall-bladder lesion in the presence of some major or minor abdominal or gynecological ailment must be arrived at only after a rigid weighing of clinical facts such as the condition of the patient to withstand the additional risk and the actual danger to the patient without immediate intervention. In the presence of two lesions it may be wise to abandon the gynecological procedure in favor of the biliary trouble when it is the dominant one. While from the mere scanning of our tables it would appear that these combined operations carry a higher mortality danger, the analysis of results does not sustain this criticism, for in three instances the second operation was too trivial to bear lethal weight in the outcome. In one there was a simple appendicectomy, in a second a small hæmorrhoid was ligated and quickly removed, while in a third a small, uncomplicated dermoid was excised. The primary mortality danger should always stand as a signal barrier to a second operation if it seems to increase the hazards; on the other hand to send a nervous or apprehensive woman from the surgical table with the prospect of a second ordeal facing her is like suspending the sword of Damocles over her head. However, in these crucial decisions a safe dictum is: "In case of doubt, defer the second operation to a more propitious time."

BILE-DUCT ANOMALY AS A FACTOR IN THE PATHOGENESIS OF CHOLECYSTITIS

By M. G. SEELIG, M.D., F.A.C.S., St. Louis, Missouri
Professor of Clinical Surgery Washington University

DURING the past 3 or 4 years, the literature devoted to the surgical aspects of gall-bladder disease is notable chiefly for two reasons. In the first place we have become more and more familiar with the technical difficulties encountered in the performance of operations for removal of the gall bladder, and repair of the bile ducts; in the second place, we have learned the importance and significance of interstitial cholecystitis associated with infection of the portal circulation and independent of primary intravesical disease.

The data secured recently, from a patient operated upon for gall-bladder disease, illustrates strikingly the anomalies of bile-duct anatomy as a factor in the pathogenesis of cholecystitis, and emphasizes the importance of technique in gall-bladder surgery.

Mrs. I. C., 29 years old, married at the age of 21, the mother of two children, had never been ill since early childhood, when she had measles and scarlet fever. For the last two years and a half, however, she had been plagued by a constant, burning pain just under the right free costal margin. This pain had always been worse at night. But the patient insisted on the fairly constant presence of it during waking hours. In addition to this constant burning pain, she had had, from once to three times a week, acute seizures of "cramping" pains, lasting from 2 to 3 hours, at times radiating to the shoulder, accompanied by nausea, but never by vomiting. There had been no jaundice or other signs of obstruction to the bile current.

Through a pararectus incision the appendix was removed. The liver was rotated upward, so as to deliver a pearl gray gall bladder about 3½ inches long by 1½ inches in diameter, so closely packed with small stones that it felt like a hard, solid organ. The foramen of Winslow was located, and by blunt dissection in the region of the pelvis of the gall bladder the cystic duct was sought. What seemed to be the duct was found without difficulty. The operative field at this stage of the operation is represented in Figure 1. Traction on the supposed cystic duct seemed to indicate its entrance into the gall bladder above, and into the common duct below. Failure to locate the cystic artery in its usual position prompted caution, however, and before the duct was clamped a more careful survey of the field disclosed the fact that the exposed duct was in reality not the cystic, but the common duct. Further exploration disclosed the cystic duct emerging from the gall bladder somewhat laterally (toward the left side), and then, kinking on itself very sharply, it coursed upward along the left lateral wall of the gall bladder for about one inch and a half. The duct then turned to the left to empty in the common duct, as shown in Figure 2. This illustration is necessarily somewhat schematized and does not show the unusual complexity of the anomaly. As a matter of fact the cystic duct, as such, was not recognizable, because it was seemingly incorporated in the gall-bladder wall, much as the appendix is sometimes found to be incorporated in the cæcal wall. Furthermore the posterior wall of the gall bladder was adherent to the common duct, so that when traction was put on the gall bladder the common duct pulled up exactly as would a normal cystic duct. The only definitely discernible landmark was the site where the terminal one-half inch of the cystic duct could be seen coursing toward its entry into the common. Figure 3*a*, a photograph of the gall bladder, shows the cystic-duct relationships as they really existed. The duct coursed alongside the lateral margin of the gall bladder, seemingly incorporated in the gall-bladder wall, extending up as far as the point *A*. After the gall bladder was removed the serosa was nicked with a knife at *A*, releasing the end of the cystic as shown in Figure 3*b*. Further division of the adhesion between gall bladder and cystic duct mobilized the entire duct as seen in the photographs 3*c* and 3*d*.

Division of the cystic duct at its point of entrance into the common duct and mobilization of the gall bladder brought into view the common duct coursing behind the gall bladder and emerging from below its pelvis, in the position normally occupied by the cystic duct (see Fig. 2).

Only the grace of fortuitous circumstance prevented severance of the common duct.

It is perfectly evident from this description that it is not sufficient merely to "expose the cystic before dividing it." It is essential to *identify* the exposed duct as the cystic; and this can only be done by actually tracing it into the gall bladder above, or into common duct below, or preferably by tracing it from gall-bladder emergence to common duct entry.

The importance of such an anomaly as has been described, does not lie solely in the

Fig. 1. View of the operative field with the supposed cystic duct in view.

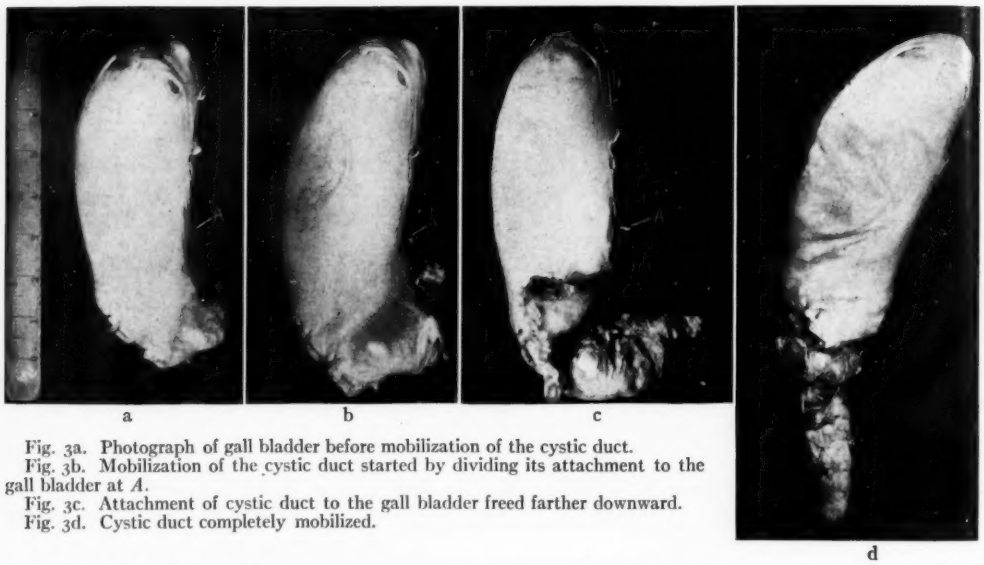
technical difficulties it creates for the surgeon. Of even greater importance is the relationship between these anomalies and pathological lesions of the biliary tract. The sharp kinking of the cystic duct at its emergence from the gall bladder opposes a barrier to the bile current and results in more or less stasis of the gall-bladder contents (Fig. 4).

In a recent paper, von Schmieden (1) emphasizes the importance of bile stasis. He believes that simple non-lithogenous obstruction to the outflow from the gall bladder may produce initial symptoms not distinguishable from those due to cholelithiasis. The first clinical symptoms of these attacks of obstruction are sharp, relatively short seizures of pain, with tenderness in the gall-bladder region, unaccompanied by fever or jaundice. The later attacks may be accompanied by signs of gall-bladder inflammation. Von Schmieden believes that in at least an appreciable number of cases, the bile stasis in the gall bladder is due to valvular kinking of the cystic duct, occasioned both by its spiral course and by the presence of Heister's valves in the duct. Figure 4 represents the gall bladder of our patient, and shows clearly how the kinking of the cystic duct was responsible for an obstruction to the outflow of bile.

It is well to remember in this connection that the formation of gall stones is supposed to depend either upon primary inspissation

Fig. 2. View of the operative field showing that what was at first supposed to be cystic duct was in reality the common duct.

and thickening of sterile bile due to incomplete evacuation (Aschoff and Bachmeister, 2) resulting in the formation of radiate cholesterin stones; or upon a so-called stone-forming catarrh or inflammation (Naunyn, 3) which leads to the formation of concentric stratified pigmented calcium stones. Most authors believe that stones are formed in accordance with both of these theories. The cholesterin stones, resulting from aseptic bile stagnation, make up about 30 per cent of all cases of cholelithiasis. These so-called aseptic stones, according to Kehr (4), may remain in the gall bladder indefinitely without inducing clinical symptoms in a large proportion of cases, "yet inasmuch as the calculi are formed in stagnant bile, they act as foreign bodies increasing bile stasis. They impede biliary ebb and flow. The contractility of the gall bladder is diminished. Residual bile remains. Further, the porous surface of the calculus and the capillary fluid surrounding it attracts bacteria. Thus the cholesterin stone, originally formed aseptically, becomes by chance an active agent of infection, by hindering the biliary evacuation of the engorged and in-



a b c d

Fig. 3a. Photograph of gall bladder before mobilization of the cystic duct.
Fig. 3b. Mobilization of the cystic duct started by dividing its attachment to the gall bladder at *A*.
Fig. 3c. Attachment of cystic duct to the gall bladder freed farther downward.
Fig. 3d. Cystic duct completely mobilized.

fected gall bladder. Thus the disease progresses from the aseptic stage through the latent period, into the acute inflammatory stage" (Kehr). Aschoff and Bachmeister confirm this opinion. More recently Rous, Peyton, and McMaster (5) have demonstrated experimentally that sterile bile within the gall bladder, under non-inflammatory conditions which prevent its discharge, becomes inspissated with surprising rapidity.

From all this, it is perfectly evident that anomalies in the anatomic relations of the cystic duct, such as have been described in this paper, are important factors in the pathogenesis of gall-bladder disease (Fig. 4). They lead in the first place to the prodromal colics, due to interference with normal emptying of the gall bladder. Then follows the stage of non-inflammatory bile inspissation, which in its turn is succeeded by concrement formation with attendant inflammatory symptoms.

Early in this sequence of events there occurs a certain amount of damage to the gall-bladder wall itself. Schmieden, who has made a most careful pathological study of distention of the gall bladder, reports that the first significant changes due to intravesical pressure are the dilatation of Luschka's ducts and a congestion hyperæmia of the wall of the gall bladder (Fig. 5). If the distention persists or increases in degree, the gall-bladder wall shows a characteristic œdema of the fibrous, subserous, and mucous layers, with a hypertrophy of the muscularis and an interstitial lymphocytic infiltration in all layers. Finally a marked fibrosis occurs, particularly pronounced in the muscular coat. The end-result is an atrophy of all the layers.

This pathological picture of interstitial cholecystitis links the problem of kinked cystic duct and consequent distended gall bladder, with the recently published work of Graham (6). Graham has clearly demonstrated for the first time, the existence of interstitial cholecystitis, with infection of the lymphatics of the gall-bladder wall from without, and he has emphasized the significance of this type of cholecystitis as a most important factor in gall-bladder disease. By implication at least, Graham seems to underestimate the significance of interstitial cholecystitis due primarily to intravesical lesions, that is to infections from within the gall-bladder cavity. He lays a great deal of stress on failure to induce cholecystitis by directly infecting the gall-bladder cavity; but he fails to mention the work of Mignot, who showed that cholecystitis resulted if attenuated bac-

Fig. 4. Gall bladder with kinked cystic duct bisected sagitally after hardening in formalin. Illustrates obstructing valve formation due to spur, plus Heister's valve.

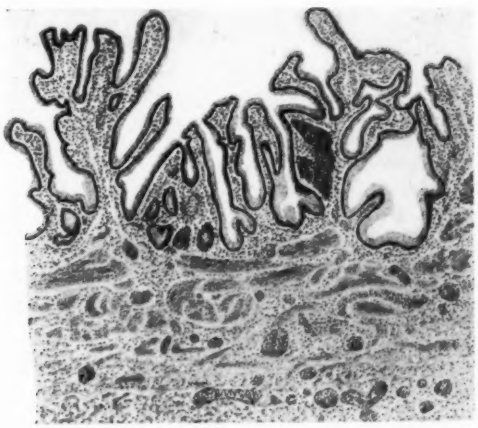


Fig. 5. Drawing from Aschoff and Bachmeister to show effect of gall-bladder distention in causing widening of Luschka's ducts, hypertrophy of the muscularis, and lymphocytic infiltration of layers of gall-bladder wall.

teria were used. Mignot's work is credited both by Moynihan and by Robson. Graham's experiments do show beyond all doubt the invasion of the gall-bladder wall by the lymphatic route from without, and they do prove the existence of an interstitial cholecystitis totally independent of a primary gall-bladder mucosa infection. His experiments, however, do not disprove the statements of Schmieden or of Aschoff regarding the dependence of interstitial cholecystitis upon intravesical stasis, nor do they disprove the existence of an interstitial cholecystitis secondary to an intravesical inflammation. As a matter of fact Graham does not set up any claims to disprove these things. He merely sets out to emphasize the frequent association of inflammation in the portal territory (appendicitis, peptic ulcer, typhoid, etc.) with cholecystitis. The cholecystitis he proves to be due to an hepatitis, which extends, by way of the lymphatics, to the gall bladder.

It is important for us to bear in mind, however, that in addition to the type of cholecystitis described by Graham, we must still reckon with the two other types of cholecystitis due primarily to intravesical inflammation, and to intravesical stagnation and tension. We must further bear carefully in mind the very explicit statement of Aschoff that "every change in a gall bladder subject to bile stasis may be ascribed solely to increased pressure. Thus the muscular hypertrophy, the enlarged Luschka's ducts, the thickened mucosa folds, and the slight lymphocytic infiltration are all due to increased pressure and increased resorbtive processes incited by the increased pressure." A rational consideration of all factors involved seems to warrant one in concluding that intravesical disturbance is responsible for more gall-bladder disease than is the invasion of the gall-bladder wall by the lymphatic route from without. And even if this statement be open to question, it is true, nevertheless, that the chapter of anomalous and kinked cystic ducts is of commanding importance in relation to the questions of the etiology of cholecystitis and the accidental surgical injury of the bile ducts.

BIBLIOGRAPHY

1. SCHMIEDEN. Arch. f. klin. Chir., 1921, cxviii, 14.
2. ASCHOFF, L., and BACHMEISTER, A. Cholelithiasis. Jena: G. Fisher, 1909.
3. NAUNYN, B. Clinic of Cholelithiasis. Leipzig: F. Vogel, 1909.
4. KEHR, H. Surgery of the Bile Ducts. Stuttgart: F. Enke, 1913.
5. ROUS, PEYTON, and MCMASTER. Proc. Soc. Exper. Biol. & Med., xvii, 215.
6. GRAHAM, E., and PETERMAN, M. G. Arch. Surg., 1922, Jan., 23 (see also Graham, Surg., Gynec. & Obst., 1918, xxvi, 521, and Arch. Surg., 1921, Jan., 92).

LIVER ABSCESS

Report of One Hundred Operations[1]

By A. I. LUDLOW, M.D., F.A.C.S., Seoul, Chosen (Korea)

THE following report of one hundred operations for liver abscess is divided into three series.

Series 1. Abscess of the liver (1).

Series 2. Supplementary report (2).

Series 3. Comprises forty additional cases.

Thirty-three of these operations were performed by my Korean associates, Drs. Oh, Pak, Koh, and Pang, and the remaining 67 by myself.

DISTRIBUTION AS TO TIME

According to time the distribution is as follows:

	Cases
1912	5
1913	4
1914	6
1915	12
1916	14
1917	4
1918	2
1919	19
1920	9
1921	18
1922 (To June 1)	7
Total	100

GEOGRAPHICAL DISTRIBUTION

According to Rogers (3): "This disease is met with most frequently in low-lying moist tropical climates. Thus it is common in the large Presidency coast towns in India, at Colombo in Ceylon, Singapore, the East Indies, Philippine Islands, Hong Kong, and the more southern parts of China. It also occurs inland in these countries, being met with in all parts of India, including the comparatively dry Punjab and Central India. In Africa it is not uncommon, in Egypt and Algiers as well as upon both coasts, while cases have also been reported from the interior. It is relatively rare in the West Indies, but occurs to some extent in the hotter parts of both North and South America."

Manson (4) writes: "Its geographical distribution is in the main regulated by that of dysentery. It has to be noted, however, that liver abscess is not a sequel or concomitant of the dysentery of all countries and at all times. Thus it is rare as an indigenous disease in temperate climates, even in those temperate climates in which dysentery is at times common enough."

In view of this statement of Manson, it is of interest to note the large number of cases met with in Chosen (Korea), a country of temperate climate. The Government Hospital in Seoul has had 49 cases of liver abscess from 1913 to 1920. Of these 46 were males and 3 females. The age incidence is practically the same as that reported in our series.

Reports from hospitals outside of Seoul show that liver abscess occurs in all parts of Korea.

PREDISPOSING CAUSES: RACE, AGE, AND SEX INCIDENCE

Race. In tropical regions the whites are far more subject to liver abscess than the natives. It has been pointed out that passive congestion of the liver is a common condition among the white inhabitants of tropical regions and that liver abscess is particularly common among white persons that abuse alcohol. A striking feature of our series is that all the patients were Koreans. We have had no cases in our American or European population (almost all of whom are treated by our staff) although amœbic dysentery is of common occurrence, about 1 in 5 having suffered from this disease. We attribute this in part to early and energetic treatment of amœbic dysentery with emetine. The climatic influences of the tropics are absent and the use of alcohol is not frequent in the white population of Korea.

Age. The following table shows the age and sex incidence of the 100 cases:

[1] Article No. 30, Research Department, Severance Union Medical College, Seoul, Chosen (Korea).

	Males	Females	Total	Percentage
0 to 10 years	2	0	2	2
11 to 20 years	3	1	4	4
21 to 30 years	35	4	39	39
31 to 40 years	34	2	36	36
41 to 50 years	14	1	15	15
51 to 60 years	4	0	4	4
Total	92	8	100	100
Percentage	92	8		

These figures of age incidence correspond closely with those reported from India.

In our Series 1, the age ranged from 7 to 50 years; average 25 years. There were two males, 7 and 10 years of age, in this series.

In Series 2, the age ranged from 21 to 53 years; average 32 years.

In Series 3, the age ranged from 16 (female) to 53 (male); average 33 years. The average for the 100 patients was 30 years.

Sex. In Series 1, there were 27 males and 3 females.

In Series 2, there were 29 males and 1 female.

In Series 3, there were 36 males and 4 females.

A total of 92 males and 8 females for the combined series, 100 patients.

Many writers have emphasized the great rarity of liver abscess in females. Rouis (5), De Castro (6), Barensprung (7), and others lay stress on this point. Rogers (3) reported only 8 females in a series of 300 cases of liver abscess. It will thus be seen that our series shows the highest percentage of females, at least so far as we have been able to find in the literature. We have about four times as many operations on men as on women but this would account only in small part for the greater number of males. While our percentage is larger than others report, nevertheless the rarity of liver abscess in females is still a striking fact.

Alcohol. One of my Korean associates made the remark one day that he observed that many of the patients who came with liver abscess were addicted to alcohol. Our records are not sufficiently accurate on this point, but I do know that many of the patients used Korean wine. The majority of our cases were also people who use alcohol.

ETIOLOGY

None of our cases gave a history of special trauma, secondary processes from the appendix or gall-bladder infection, in fact, the latter infections are not at all common in Korea. About 90 per cent of our cases were at some period associated with diarrhœal conditions the majority of which were probably amœbic in origin, at least the history would indicate this diagnosis. Furthermore amœbic dysentery is frequent in this locality, and, as a rule, the Koreans pay little attention to its treatment but as they say, "Allow it to run until it stops."

Amœba histolytica was found in 10 per cent of the 50 cases in which fæcal examination was made. I have no doubt that this percentage would be much greater if repeated and special search had been made for the amœba. It should also be remembered that several of the early cases were operated upon before our laboratory work was well organized. Although amœbæ have been discovered in the walls of some of the abscesses and there have been reports of primary sterility of the pus yet these reports are not sufficient in number to be of special value. In practically every case the abscess has developed slowly and at times with no history of fever.

As recorded later many cases had no fever upon admission to the hospital. Most of the cases have been large single abscesses well localized and presenting dense fibrous walls (see Fig. 1). All these facts agree with the usual etiology of tropical abscess of the liver.

THE ABSCESS

Number of abscesses. All the abscesses in the individual lobes were single or easily converted into single abscesses.

Size of the abscesses. The size varied from a cavity 4 centimeters in diameter to those which involved nearly the entire lobe holding a liter or more of pus. Those which had ruptured contained as much as three liters. The pus was dark red in color, of foul odor at times, and in some cases contained large shreds of liver tissue. In some of the large abscesses the first pus was thin followed later by pus so thick that it had to be scooped out.

Position of the abscess.

	Right lobe only	Left lobe only	Both lobes
Series 1	28	0	2
Series 2	29	1	0
Series 3	36	1	3
Total	93	2	5

COMPLICATIONS

a. Intestinal parasites. Intestinal parasites are very common in Korea and were found in 45 out of 50 cases in which fæcal examinations were made, as follows:

Parasite	No. of times
Trichuris	40
Ascaris	30
Amœba histolytica	10
Ankylostoma	7
Tænia	5
Oxyuris	5

b. In the sputum of seven patients the ova of paragonimus westermanii were found. Distoma is common in Korea. In 2 cases the sputum showed tubercle bacilli.

c. Rupture in the pleura occurred in 9 cases.

d. Rupture through the chest wall with large ulcer, 1 case.

e. Necrosis of the ribs, 5 cases; two preoperative and three postoperative (see Fig. 2).

f. Rupture into the abdominal cavity, 5 cases (see Fig. 3).

g. Albumin in the urine, 6 cases.

h. Ascites was present in 6 cases.

i. Morphine habit, 1 case.

THE BLOOD

Marked anæmia was present as a rule only in those cases in which there were complications, for example, in the hookworm patients. One patient with both distoma and hookworm had 45 per cent hæmoglobin and 2,500,000 red cells. The uncomplicated cases had a fairly normal blood count. Very few presented a high leucocytosis, 27,400 being the highest reported. Some of the patients with the largest abscesses showed a normal number of white cells.

SYMPTOMS

While the symptoms presented were variable, yet almost every patient gave a history of diarrhœa, fever, chills or sweats at some time during the period of illness. Pain in the right hypochondrium especially on pressure is also present. The following records of pulse, temperature, and respirations of cases at the time of admission to the hospital show how these signs may be of little help.

These were selected at random from the series.

Pulse	Temperature	Respirations
60	36	18
76	36	18
100	36.5	24
102	36.9	24
102	38.2	30[1]
94	37.2	24
100	38	22
60	37	15
80	37	20
76	36.5	27
80	37	20
86	37	20
78	37.5	19
100	38	22
96	36	24
96	37	24
72	36	18
60	36.5	18
88	35.2	18
90	37.2	20

Many of the patients presented the septic condition so often observed in cases of chronic empyema. Icterus was observed in only three or four cases. In the larger abscesses there was an absence of symmetry with bulging in the lower intercostal spaces of the right side. In eight cases distinct swelling was observed in the epigastric region and in five cases in the right side of the abdomen, in one case as far down as the right iliac region. In one case there was a rupture of the abscess on the chest wall with a large ulcer and in still another a sinus opening at the umbilicus.

Enlargement of the liver below the costal margin could as a rule be detected by palpation except in the cases accompanied by much ascitic fluid. Deep fluctuation was obtained in ten cases.

SPECIAL SIGN

There is one sign to which I wish to call special attention as a help in diagnosis. This sign is deep-seated pain in the region of the abscess elicited by a sudden thrust with the end of the finger. We usually begin with the unaffected side to accustom the patient to this stroke. The most common point at which this sign appeared was the ninth interspace, about 2 inches from the right costal border. This sign has been almost constant.

With few exceptions (the small abscesses)

[1](Rupture in pleura)

Fig. 1. Liver abscess. Area of dullness in a large single abscess.

Fig. 2. This patient suffered pre-operative necrosis of the ribs. Operation in 1916. Photograph taken in 1919. Patient seen in May, 1922, and was still in fine health.

Fig. 3. Photograph taken before operation. Area of dullness painted with iodine. Abscess ruptured into abdominal cavity and walled off.

Fig. 4. Photograph 3 weeks after operation, illustrating case with double incision. This was the oldest patient in the entire series—age 53.

percussion revealed an increase in liver dullness, most frequently upward, so that at the nipple line the curve of dullness began to rise and often reached the fifth and at times the third rib in the mid-axillary line, and the angle of the scapula, posteriorly.

If the above symptoms are found in any one case the diagnosis would be simple, but at times the onset of the disease is insidious and such cases may be devoid of special symptoms on entrance to the hospital. We have already shown how misleading the pulse, temperature, and respirations may be. An important factor in diagnosis is a mental attitude of suspicion which should prevail in the mind of the physician who is located in a region where amœbic dysentery is common. We attribute many of our findings to this attitude of mind.

With the coming of Dr. Hopkirk to our X-ray department we are finding help in diagnosis through this means.

TREATMENT

Prophylactic treatment. L. Rogers (8), in closing his lectures on amœbic liver abscess stated: "Amœbic or tropical liver abscess is an easily preventable disease in the great majority of instances and the occurrence of amœbic suppuration in the liver should cause serious question in the mind of the medical man in whose hands it has been allowed to develop." Our experience would bear out this statement for we have never seen a liver abscess develop in any foreigner or Korean who has been under the care of the staff of this institution. The early and energetic treatment with emetine together with the other measures usually employed in amœbic dysentery should be almost specific against liver abscess. All of our cases have come to the dispensary or hospital with well-developed and for the most part long-standing abscesses. These, of course, necessitate some form of operation.

Operations. Among the operative procedures advocated for abscess of the liver are the following:

Aspiration method. This may be done by means of a trocar and cannula with a rubber tube for drainage. This method was used with success by Manson. Some of the disadvantages are: (1) Open operation frequently has to be resorted to after aspiration has failed. At times, however, this is not a great objection for the patient may in some cases be relieved

and gain strength. (2) Difficulty of retention of tight-fitting cannulas or stiff rubber tubes, on account of the constant movement of the liver. (3) The pus is sometimes not discovered by aspiration or may be too thick to flow through the cannula.

Treatment by aspiration together with the use of emetine seems to promise good results; at least some of the late reports would so indicate. De Bellard (9), in the *Cacete médica de Carácas*, February 15, 1919, reported two cases of liver abscess treated before operation with subcutaneous injections of 0.04 grain of emetine morning and evening for 4 days. He then aspirated the contents of the abscess and injected 0.15 grain of emetine in 30 cubic centimeters of distilled water into the abscess cavity. Both cases are reported cured.

L. Rogers (8), in the lecture above noted, states: "In patients coming first under observation with an already formed amœbic abscess, whenever possible, the treatment of choice should be repeated aspiration and subcutaneous injection of emetine in preference to incision, while when such an abscess has eventually to be opened some form of sterile syphon drainage should be used. A little over a decade ago liver abscess was second only to typhoid in its lethal effects on the British soldiers in India, causing nearly 100 deaths a year among them but the death rate has already been reduced to one-sixth by the method Rogers has advocated." In our first two series (60 cases), we resorted only to operation by the open method although in many cases, perhaps a fourth, subcutaneous injections of emetine were used.

In 1919 we tried two cases by the method advocated by De Bellard. In the first case we were able to obtain only a small amount of pus by aspiration—about 200 cubic centimeters. Later we operated and evacuated 2.000 cubic centimeters of very thick pus. In the second we aspirated 300 cubic centimeters of pus, but had to operate 4 days later and obtained 1,000 cubic centimeters of very thick pus. In neither case did the emetine seem to thin out the pus.

Since my return from furlough we are trying again the aspiration method in cases not in this series, with promise of good results.

Method of approach through abdominal incision. In this operation as usually performed, incision is made in the epigastric region or right rectus, the liver is fixed to the abdominal wall by rows of sutures through its capsule and the peritoneal covering, to the edges of the abdominal incision. The opening is maintained by packing, and the incision of the abscess delayed 24 to 48 hours. The disadvantages of this method are: (1) two operations are necessary; (2) drainage is not so good; (3) the stitches are liable to pull away and infection of the abdomen may occur.

Transthoracic method. In his book on *Tropical Medicine*, Jackson (10) writes: "If there is bulging between the ribs we may expect the abscess to have for its coverings the diaphragm and the pleural layers. These will require stitching together in order to prevent the escape of pus into the pleural cavity. A resection of one or two ribs must precede this stitching. This done the abscess may be opened by an incision through pleura and diaphragm. Deep-seated abscesses should rarely be approached in this way as the steps of rib resection, uniting the diaphragmatic and the parietal pleural layers, anchoring of the liver to the wound and incision of the hepatic peritoneum, are all preliminary to the search for pus within the liver substance. The situation of the liver at the bottom of a deep recess, its movements to and fro unite to make this a deservedly unpopular operation."

The point of election for the large majority of our operations has been the ninth rib, about 2 inches from the costal margin on the right side. At this point the pleura is rarely encountered and we have found the technical operative difficulties mentioned by Jackson not at all troublesome at this site.

The writer's general plan. We believe that each case of liver abscess must be treated according to the findings and that no hard and fast rule can be made for every case. The following, however, may be given as the general plan which we have used in most cases.

A preliminary treatment by emetine subcutaneous injections of 0.06 grain is given daily for 2 to 4 days provided the patient's condition will permit of that much delay. During this

time we also deal with the intestinal parasites so frequently present.

In our first two series, the aspirator was employed for diagnosis only and used when the patient was brought to the operating room and all was in readiness to proceed with the operation. Many cases have been aspirated for diagnosis before coming to our service and we are inclined to put less emphasis than formerly on the dangers of aspiration.

We usually give a preliminary dose of morphine, 0.06 grain. The aspirator is inserted under local anæsthesia. If the patient's condition is serious it is wise to attempt the operation under local anæsthesia. Local anæsthesia (novocaine ½ per cent) with gas and oxygen would be ideal, but we have no means as yet of using gas anæsthesia. Only positive findings with aspiration are of value. In certain cases where the existence of an abscess is strongly suspected, we have operated after failure to obtain pus by aspiration and have each time evacuated a large abscess filled with thick pus. Lately when the diagnosis has seemed certain we have operated without use of the aspirator for diagnosis.

If a general anæsthetic is necessary, ether is preferable and must be used with great care and as little as possible must be given.

Incision of election. The incision is made parallel to the ninth rib, beginning about 2 inches from the right costal margin and extending outward. A portion of the rib 2 or 3 inches long is resected, the diaphragm incised, and the liver exposed. A small incision is made in its capsule, blunt scissors are inserted into the abscess cavity, and the wound is enlarged by opening the scissors and drawing them out. During this last procedure the patient is turned a little to the right. As soon as the cavity is opened the first finger of the left hand of the operator is inserted, and the liver held close to the wall while the pus is allowed to escape. After most of the pus has been evacuated, the first finger of the right hand may be inserted into the cavity and search made for any other compartments of pus or large masses of thick pus scooped out. When we first began to operate upon these cases, an attempt was made to sew the liver to the parietal peritoneum. The stitches would frequently tear away even before the operation was finished. We gave up this procedure and found no ill effects resulting. In only a few cases did we ever encounter the pleura, and this was easily sewed with no bad results. After most of the pus is evacuated we pack the cavity with gauze which is left undisturbed for 2 days. After this the abscess is drained with a rubber tube and gauze. We have used both Dakin's and hypertonic saline solutions for irrigation. Neither solution has hastened the healing to any marked degree. Dakin's solution does, however, dissolve the thick pus and make it run out easier.

We continue the injections of emetine (0.06 grains daily) for 4 days after operation or a week or more longer if there are symptoms of active dysentery. We have also used tri-methol as an intestinal antiseptic.

In large abscesses, after the pus has been evacuated and the liver begins to contract, the drainage has at times been interfered with by the changed position of the liver. It is necessary to keep a good opening for drainage. If this is left to an assistant, unless he is well instructed, he is apt to allow the external opening to close too quickly. In three cases the ends of the divided ribs became infected and required secondary operation. We now cover the ends of the divided rib with periosteum.

Abdominal incision. In cases where the abscess has ruptured into the abdomen, in our series, the operation consisted of drainage at the lowest point, even though it required a second incision. Where the abscess has not ruptured but the liver projects into the epigastric or hypochondriac region we have proceeded according to the method mentioned above in "The Approach through the Abdominal Incision," except that we have opened the abscess at the time of the operation. In several cases we have combined the abdominal incision with that of the ninth rib (see Fig. 4).

MORTALITY

Most of the mortality reports of liver abscess are high.

Manson (4) records the mortality of liver

abscess as follows: "Rouis (203 cases) in Algiers observed a mortality of 80 per cent; Castro (125 cases) in Egypt, a mortality of 72.5 per cent or excluding cases operated on, of 76 per cent; in the Indian army during the period 1891 to 1894, prior to which abscess of the liver, in the statistical report is not separated from hepatitis and presumably included cases operated on, the mortality was 57.7 per cent."

Rogers (8) reports: "Among British troops in India for 15 years from 1894 to 1908 the fatalities averaged 56 per cent." The mortality as worked out by Rogers shows 73.4 per cent of those operated upon through the chest wall, 46 per cent through the lungs and 40 per cent through the abdomen. Cantlie (100 cases) using the Manson method of aspiration and drainage has a mortality of 18 per cent. Rogers reports 14 per cent mortality in 21 cases treated by aspiration and quinine injections. Lately Rogers in the lectures above quoted says: "The death rate among British soldiers in India has been reduced one-sixth by the method of aspiration and injection with emetine."

The mortality of our series is as follows:

In the first series (30 cases) there were four deaths (13.3 per cent).

In the second series (30 cases) there were three deaths (10 per cent).

In the third series (40 cases) there were three deaths (7.5 per cent).

The mortality for the combined series of 100 operations was ten deaths or 10 per cent.

The following may be noted in the fatal cases:

CASE 1. Male, age 23 years. Previous to operation rupture of abscess in pleura and abdomen. Albumin in urine. Hookworm.

CASE 2. Male, age 30 years. Rupture in pleura. Pulmonary tuberculosis.

CASE 3. Male, age 31 years. Active amœbic dysentery. Rupture of abscess into abdomen before operation. Ascites present.

CASE 4. Male, age 26 years. Large abscess of 3,000 cubic centimeters. Rupture into abdomen. Hookworm.

CASE 5. Male, age 30 years. Rupture into abdomen. Active dysentery.

CASE 6. Male, age 41 years. Large central abscess, case complicated by active dysentery, ascites, and pleural effusion.

CASE 7. Male, age 46 years. Patient was so ill that no history was obtainable. At first it was difficult to determine whether he had a chronic empyema or liver abscess. There was a fistula leading down to the eighth rib in the right posterior axillary line. Upon operating we observed that a portion of the seventh and eighth ribs for a distance of 5 centimeters was necrosed and that the ribs had spontaneously fractured. Beneath was a large abscess cavity extending from the third to the tenth rib. It was only after excision of a portion of the abscess wall and microscopical examination of the tissue that we were able to arrive at a positive diagnosis of liver abscess.

CASE 8. Male, age 38 years. This patient was in critical condition upon entering the hospital being a victim of the morphine habit. He left the hospital before permission was granted, and we feel sure that he could have lived but a short time so include him in the mortality list.

CASE 9. Male, age, 30 years. Rupture into the pleural cavity.

CASE 10. Male, age 28 years. Patient very weak on admission to the hospital. His temperature was markedly subnormal, below 36 degrees C. The abscess was a large one and had ruptured into the pleural cavity.

SUMMARY

1. Although Korea has a temperate climate, both amœbic dysentery and amœbic liver abscess are common among the Koreans.

2. While amœbic dysentery is common among the white population, amœbic liver abscess has not been observed.

3. Liver abscess is infrequent before the age of 20 years. The average age of our series is 30 years.

4. The incidence of liver abscess in Korean females is 8 per cent—a larger percentage than that reported in other countries.

5. The large single abscess of the right lobe of the liver predominates.

6. Liver abscess develops as a rule insidiously. A large abscess may be present with normal pulse, temperature, respirations and blood count.

7. Deep-seated pain in the region of the abscess elicited by a sudden thrust with the end of the finger is an important and practically constant sign.

8. The early and continued treatment of amœbic dysentery with emetine will prevent liver abscess in most instances. We have seen no case of liver abscess develop in Koreans or foreigners thus treated.

9. Although we have operated upon all of our cases by the open method, yet if the pus flows well on aspiration late reports of other observers indicate that this method together with the injection of emetine should be tried. Our late experiences not reported here give promise of good results by this method.

10. Keep a mental attitude of suspicion of the possibility of liver abscess in localities where amœbic dysentery is prevalent.

BIBLIOGRAPHY

1. Ludlow. Abscess of the liver. China M. J., 1917, May.
2. Idem. Supplementary Report. China M. J., 1920, May.
3. Rogers. Fevers in the Tropics.
4. Manson. Tropical Diseases.
5. Rouis. Sur les suppur. endem du foi, Paris.
6. De Castro. Des absces du foi, Paris, 1870.
7. Barensprung. Arch. f. klin. Chir.
8. Rogers. Lancet, Lond., 1922, April 8.
9. De Bellard. Gac. méd. Carácas, 1919, Feb. 15.
10. Jackson. Tropical Medicine.

RUPTURE OF THE LIVER

With Report of a Case in Which Autotransfusion was Employed

By CHARLES STANLEY WHITE, M.D., F.A.C.S., Washington

TRAUMATIC rupture of the liver is probably much more common than reported cases would indicate, as lacerations without distinctive symptoms pass undiagnosed and are included under the general caption of shock. While it is often associated with injuries in which a vehicle passes over the body, serious damage may be done the liver by seemingly mild violence, and rupture of the liver without fracture of a rib is fairly common. There is no constant relation between the trauma, as noted in the history and the clinical symptoms; nor does the damage to the overlying ribs or integument furnish grounds for a reliable diagnosis.

The symptoms are those of acute internal hæmorrhage plus trauma in the liver region. The hæmorrhage may be of such violence that death results speedily, or may be so slight that it is not distinctive and remains undiscovered. Rupture of the liver may be attended with rupture of the stomach or intestine, and the symptomatology may have all the aspects of peritonitis, with the liver lesion in the background. The outstanding features are those of acute hæmorrhage, and its blood picture, with history or evidence of trauma in the anterior, lateral, or posterior aspects of the right chest. If the amount of blood that has escaped has been large, there may be physical signs of fluid in either flank.

In the case herein reported, we aspirated the peritoneal cavity with a large needle, and we are of the opinion that the procedure is safe and of considerable value, although it does not exclude the diagnosis of a traumatic perforation of the intestine or stomach.

The difficulty lies in determining if shock alone exists, and while theoretically the distinction between shock and hæmorrhage may be clear, practically the diagnosis may present obstacles which cannot be surmounted in the brief time that the exigency permits. The blood examination loses some of its value should an anæmic individual be the victim of an accident, provided no previous examination of the blood has been made. Aspiration of the peritoneal cavity is most helpful in determining if we are dealing with shock or with hæmorrhage from the liver.

Many cases of even severe hæmorrhage following rupture of the liver survive, because spontaneous arrest of the bleeding may occur, and those patients who survive the injury 3 days, usually recover. We do not look upon hæmorrhage from the liver as of an infective nature, but the possibility of infection from this source must be reckoned with. There is sufficient proof of the presence of organisms in the portal circulation and in liver bile, and pouring out of bile and blood into the peritoneal cavity from a traumatized liver is not

without risk of peritonitis. The actual occurrence, however, is rare.

In the severe hæmorrhage, the operative abdomen is so manifest that there is rarely any hesitancy in exploring. In the milder types it is not easy to decide whether to depend upon spontaneous arrest of hæmorrhage or to adopt the more active course. We are guided in these cases by the frequent blood examinations and pulse rates. It may be difficult to eliminate the possibility of visceral rupture, but we believe that vomiting is more conspicuous and the leucocyte count is higher in perforation than hæmorrhage. Rigidity and tenderness are not valuable as early signs, and the condition must be recognized early if we expect a successful issue. Between rupture of the liver and a contusion of the chest or abdomen, the differential diagnosis lacks the textbook character. Blood examination every hour with especial reference to the hæmoglobin and red cell count is the most reliable. The specific gravity of the blood is of doubtful service and the leucocyte count is in no sense pathognomonic. Rigidity, tenderness, and vomiting may be present in both. Sufficient free blood in the peritoneal cavity to give physical signs places the case in the class of severe hæmorrhage, and its recognition by the blood examination and subjective symptoms is usually made. We believe the more general use of the aspirating needle would prove dependable in those cases where the hæmorrhage is not great and the diagnosis rests between shock and mild hæmorrhage. In any case of doubt, the mortality will be less if an exploration is made rather than to wait for developments.

The actual control of hæmorrhage from the liver is attended with many difficulties, among which are inaccessible or deep lacerations, stellate lacerations, and the friability of the liver. Lacerations which can be reached by a suture are best closed by sutures which first parallel the torn surface, and these in turn are used as stanchions behind which other sutures are carried and cross the fissure. The parallel sutures of catgut give a stability which the liver alone does not possess. Lacerations difficult or impossible to suture may be packed with gauze, cauterized with a blade, or, better yet, brought together by packs placed against the liver. Drainage of the region of the liver should always be instituted.

The following case presents some usual and unusual features of rupture of the liver.

J. B., colored, age 18, chauffeur by occupation, was admitted to the Emergency Hospital at noon, November 29, 1920, for a contusion of the abdomen following a fall over a concrete frame.

His family and previous history are unimportant.

When admitted to the emergency service, he was treated for a contusion of the right chest and shock, and after remaining in the rest room 7 hours, he was sent to the ward. The record shows that at 7:45 p.m., while in the ward, his pulse was 136, respiration 18, and temperature 95.6. He was given caffeine-sodium-benzoate and morphine sulphate. His condition evidently did not excite interest or attention, for he was not seen by an interne until 8:30 a.m. the following day. He was given morphine and an enema and expelled some gas. At noon his pulse was 140, respiration 36, and at this hour we were called to see him and found the patient in a state of collapse, a tender abdomen, with slight dullness in both flanks and a systolic blood pressure of 83. The urine showed a trace of albumin and a few granular casts. He was evidently suffering from an internal hæmorrhage, but whether it was complicated by rupture of the stomach or intestine was the question, but the absence of vomiting favored the diagnosis of internal hæmorrhage only.

A medium sized needle on a large hypodermic syringe was used to aspirate the left flank, directing the patient to turn to the left side to promote any fluid present to gravitate in that direction. Plunging the needle through the abdominal muscles, it could be felt to pass into a non-resisting area and, upon withdrawing the piston, the syringe was filled with blood. A portion of this was placed on a slide for examination and a culture made from the remainder, which subsequently proved to be sterile. The slide showed no change in morphology of blood cells.

A blood examination was made and reported as follows: red blood cells 2,800,000; white blood cells, 17,000; hæmoglobin (Dare) 45 per cent.

The Murphy drip was started at once and hemoplastin administered by hypo. He did not retain the drip very well and frequently removed the tube, appearing slightly delirious. He seemed to be growing progressively weaker. His pulse at 6 p.m. was 146 and of poor quality. It was decided to transfuse him before opening the abdomen, but we were unable to obtain a donor until 7 p.m., and the only voluntary donor of his type was his aunt. Five hundred cubic centimeters of citrated blood was introduced by the indirect method, and immediately thereafter the abdomen was opened. The peritoneal cavity was literally filled with liquid blood. Much

of this was aspirated into a sterile jar, into which had been previously placed 60 cubic centimeters of 2 per cent sodium citrate. No wound could be found in the stomach or intestines. A long, deep laceration could be distinctly felt in the dome of the right lobe of the liver, immediately beneath the diaphragm and evidently the source of the hæmorrhage. This was packed with gauze and, as there seemed to be no contamination of the blood withdrawn from the abdominal cavity, we decided to transfuse the patient with this blood, and used the vein in the right elbow for this purpose, introducing 500 cubic centimeters. The patient left the operating room in fair condition, all things considered, but spent a restless night and once got out of bed. During the following week his pulse varied from 100 to 146 and his temperature from subnormal to 102°. About this time we learned that the donor had a 4+ Wassermann and that the recipient was negative. Wassermann tests were made weekly during the next 3 months and all were negative, although no antisyphilitic treatment was instituted. The packing was removed from the liver on the eighth day under gas anæsthesia.

Two weeks after admission his temperature showed extensive excursions and a physical examination indicated fluid in the right pleural cavity. An X-ray report, under date of December 16, states: "The diaphragm on the right side is elevated and immobile. There is a moderate amount of fluid in the right pleura. There also appears to be a second fluid level below the dome of the diaphragm with a small collection of gas above. The appearance of the latter is strongly suggestive of a subphrenic collection of fluid, possibly a subphrenic abscess."

The right pleural cavity was aspirated, withdrawing bloody fluid (apparently unadulterated blood), a tube inserted through the cannula, and the Mozingo method of irrigation used. A culture of the fluid showed no growth. Frequent irrigations of the cavity soon reduced its contents and allowed expansion of the lung. On December 27, the roentgenologist (Dr. Groover) reported the fluid in the chest almost absent, but a very definite collection of fluid and a gas bubble between the right lobe of the liver and the diaphragm. The irregular temperature continued and on January 7, after aspirating posteriorally between the diaphragm and the liver and obtaining a foul, bloody liquid, we introduced a small drainage tube and irrigated this space several times daily. A culture of the fluid showed the Friedlaender bacillus. The temperature continued to oscillate and his general condition was not good, having become much reduced in weight and strength. The pulse rate ranged from 106 to 120.

The X-ray report of January 14, 1921, states: "The subdiaphragmatic fluid level is somewhat lower than at previous examination. The gas bubble between the fluid and the diaphragm appears somewhat larger and the cause of the gas bubble is not definitely understood."

On January 31, the opening between the liver and the diaphragm was much enlarged so that the finger could be introduced. A large quantity of old clots, or degenerated liver substance, was removed. At this time gas escaped also. Microscopical examination of the débris showed that the mass had undergone hyaline degeneration and no cellular arrangement could be seen. The following month there was no appreciable change in his condition; there was a variation of about four degrees daily in his temperature, his pulse averaged about 112, his urine contained albumin and the leucocyte count was usually between 12,000 and 15,000. Beginning March 1, after all wounds were closed and no fluid could be obtained from either the thoracic cavity or beneath the diaphragm, his condition improved, and he was allowed to get out of bed about the middle of the month. He then weighed 85 pounds. His pulse finally remained less than 100, his temperature was never above normal, and he was discharged March 19, or about three and one-half months after admission. His Wassermann was negative March 15, and the only blood culture made was negative. On April 27, he weighed 125 pounds, a gain of 40 pounds since March 15. He stated that he was in perfect health.

The direct and indirect methods of transfusion are common therapeutic methods, but the so-called auto-transfusion, by which is meant the patient's own blood, lost by internal hæmorrhage, is introduced into his circulation, has been seldom employed and the literature contains little information regarding it.

Thies (1), a German gynecologist, is given the credit of first employing auto-transfusion clinically, and in his report in 1914, he cites three cases of extra-uterine pregnancy in which he baled blood out of the abdominal cavity, mixed it with salt solution and injected it into the veins of his patients. All recovered. Other German operators have taken up this method, and reports have been published by Eberle (2), Henchen (3), Lichtenstein (4), Burgkhardt (5), Friedemann (6), Kreutor (7), Kulenkampff (8), Schafer (9), Schweitzer (10), the latter in June, 1921, citing twenty-one cases in which he reinfused the patient's own blood. We have not found in American or English literature any reference to this method.

The blood for such purposes is usually found in the abdominal cavity as the result of rupture of the liver, spleen, or uterus, injury to the mesentery, or extra-uterine hæmor-

rhage. One operator has used blood from the pleural cavity, but this source, as well as that from the uterus, seems hardly justifiable owing to the probability of contamination. Blood, to be used for this purpose, must be above suspicion in so far as infection is concerned. It has been stated by competent observers that during health, the liver blood frequently holds pathogenic organisms in suspension.

Blood which has disintegrated loses many of its desirable qualities, and it has been noted that the older the blood, that is, the longer the period after hæmorrhage, the less its value as a transfusion agent. In the peritoneal cavity, blood retains its morphological character much longer than the same blood exposed to air. The clotting of blood interferes physically as well as chemically in its adaptation for this purpose. The clots, however, can be strained and washed, so that they are not a total loss.

In removing blood from the peritoneal cavity, in the early report of cases, sponges were dipped into it and wrung out over a receptacle containing salt solution, or a solution of sodium citrate. Later, a ladle or spoon was used for the same purpose. We found that the Balfour aspirator was ideal, permitting a thorough and quick method of obtaining it, and we do not agree with the statement that the aspirator traumatizes the blood more than the slower ladle method. The motor or hydraulic aspirator certainly accomplishes the same result in less time, with less injury to the viscera and more completely than can be done in any other way.

We have proceeded in the following manner: As soon as the abdomen is opened, having previously sterilized all parts of the aspirating outfit which come in contact with the blood, and having placed 50 cubic centimeters of 2½ per cent of sterile citrate of soda solution in the receptacle; the nozzle of the aspirator is introduced into the peritoneal cavity and the blood removed. If more than a pint is obtained, a second cubic centimeter of sodium citrate is added to the container. An excess of citrate does not appear to be harmful. The source of the hæmorrhage is found and receives appropriate surgical treatment. If a ruptured intestine is found, or any gross contamination of the blood is seen, the blood cannot be used. The citrated blood is then poured through gauze into the infusion outfit and introduced into a vein of the arm by an assistant without interrupting the operation. We have used from 500 to 700 cubic centimeters of blood, believing that a larger quantity is not without danger of embarrassing the heart, although Kulenkampff infused 2¼ liters. We have obtained more than 1,000 cubic centimeters of blood from the abdomen and have been almost reluctant to discard the excess over 750 cubic centimeters. It may be possible, although we have never done so, to refrigerate the blood from the abdomen and keep it in reserve for that particular patient from whom it was removed, or for any other suitable case. It has always appeared a needless waste to see 500 to 1,000 cubic centimeters of blood removed from the abdomen and emptied into a bucket of soiled sponges.

Reactions following transfusions, irrespective of the methods, are not dissimilar, the chief characteristics being a chill, rise of temperature, and aching of the back and limbs. The percentages of reactions in transfusions vary greatly according to the various reporters, apparently depending upon the technique, typing, and condition of the recipient. One reaction in every 2 to 5 cases has been recently reported by Bernheim. We had two reactions in 6 cases of autotransfusions. Whether these reactions were due to the blood re-infused, which had undergone some change, chemical rather than physical, or the additional stress of the operation the patient must bear, are conditions which have not been apparent, and as far as we know, have not been investigated. A patient with a traumatized abdomen, with acute excessive hæmorrhage, cannot be compared from the standpoint of reaction, with the case in which transfusion is commonly done. We can simply state that in our brief experience the reaction in autotransfusion is more frequent than in other methods.

Autotransfusion is indicated in active hæmorrhage in the abdomen, of such gravity as to jeopardize the life of the patient if no

other means are at hand to supply the blood. Contamination of the blood in any manner, either by nature of the injury or in preparation of the blood, contra-indicates its use. Extra-uterine pregnancy would seem to be the ideal indication for auto-transfusion and has been the most frequent condition in which it has been used. Better diagnoses have reduced measurably the mortality in ectopic gestation and the necessity for transfusion is infrequent, but when the necessity does arise, the larger hospitals and communities are usually able to supply a donor on brief notice.

The best laid plans go astray at times and likewise the diagnosis. It is when the ruptured tube with the hæmorrhage is unexpected or the picture moves with unusual swiftness that auto-transfusion is an agency that meets the requirements. Rupture of the liver, spleen, gunshot wound of the mesentery, the volume of hæmorrhage, the call for speed, the delay in obtaining a donor, justify the use of auto-transfusion. We feel that blood from a ruptured uterus, or from the pleural cavity, should not be used for this purpose, although some operators have done so.

Aside from the gratifying recovery of the case reported above, it has been a source of much interest, and several features are worthy of consideration:

1. Aspiration of the peritoneal cavity for diagnosis seems a perfectly rational, safe, and valuable method at our disposal. Puncture of the intestine by such procedure is attended with more theoretical than real danger. We have only to recall with what facility and security the roentgenologist employs the needle in the pneumoperitoneum X-ray photography to verify this.

2. Auto-transfusion (or re-infusion) has a limited field of application, but when indicated is a great aid in serious emergency. It seems free from risk. We have repeated it five times successfully since this case came under our observation.

3. The introduction of blood of a syphilitic into the circulation of a patient free of this disease does not necessarily transmit the disease. This is not a new observation, but confirms other clinical reports.

4. We account for a sterile fluid in the abdominal cavity at operation, sterile fluid in the pleural cavity, and a fluid containing Friedlaender's bacillus between the liver and diaphragm by infection through the portal vein. The gas bubble between the liver and the diaphragm, which was removed by free drainage and did not recur, was probably due to infection by the Friedlaender bacillus.

REFERENCES

1. Thies. Zentralbl. f. Gynaek, 1914, xxxviii, 1191.
2. Eberle. Schweiz. med. Wchnschr., 1920, l, 961.
3. Henchen. Zentralbl. f. Chir., 1916, xliii, 201.
4. Lichtenstein. Muenchen. med. Wchnschr., 1915, lxii, 1597.
5. Burgkhardt. Zentralbl. f. Gynaek., 1920, xliv, 724.
6. Friedemann. Zentralbl f. Gynaek., 1920, xliv, 398.
7. Kreutor. Muenchen. med. Wchnschr., 1916, lxiii, 1498.
8. Kulenkampff. Zentralbl. f. Gynaek., 1920, xliv, 396–398.
9. Schafer. Zentralbl. f. Chir., 1916, xliii, 417.
10. Schweitzer. Muenchen. med. Wchnschr., 1921, lxviii, 699.

FUNCTIONAL LIVER TESTS

An Experimental Study

By VINCIL ROGERS DEAKIN, M.D., and EVARTS A. GRAHAM, M.D., St. Louis
From the Department of Surgery, Washington University School of Medicine, St. Louis

IF the recent prominence which has been given the subject of non-surgical biliary tract drainage in medical literature by Lyon, Smithies, Einhorn, and others has done nothing else, it has served to emphasize the ease with which duodenal intubation may be accomplished, and this in turn has stimulated a revival of interest in what is still generally considered to be a closed chapter in the history of the liver and duodenum, the question of an hepatic functional test.

In theory, at least, a procedure for such a test is at once suggested which does not look impossible. The most evident function of the liver lies in its ability to excrete bile, just as the kidneys excrete urine. In the renal functional test of Rountree and Geraghty the urine is collected for us by means of the urinary tract. In the case of the liver, the optional procedure would appear to be to collect the bile through a duodenal tube. In the renal test a dye, phenolsulphonephthalein, is employed, and the basis of the test lies in the amount of the dye which the kidneys are able to excrete in a given time. The investigations of Abel and Rountree have called attention to a dye, phenoltetrachlorphthalein, which might be of similar use in an hepatic functional test. The inference, then, is that given a duodenal tube, which may be passed into the duodenum under the precautions prescribed by the Lyon-Meltzer method of biliary tract drainage, a magnesium sulphate solution to irrigate the duodenal mucosa and relax the common duct sphincter, and a dye which is known to be excreted by the liver in the bile, why should not an hepatic functional test be evolved, in which the amount of phenoltetrachlorphthalein recovered over a given interval of time shall be an index of biliary efficiency?

Immediately, however, a host of objections, real and otherwise, suggest themselves. For instance, would the excretion of so much dye over a certain period of time in the outflowing bile be a measure of the function of the liver? The production of bile is not the sole task of the liver; certainly it is doubtful whether such a determination of dye output would be a measure of damage to liver tissue. On the other hand, if a dye like phenoltetrachlorphthalein was found to be as reliable in liver disease as phenolsulphonephthalein seems to be in renal function, it is at least not unreasonable to assume that a lowered phenoltetrachlorphthalein output might represent a comparable degree of pathological change in the liver substance.

Another objection would arise, about which is centered much of the controversy regarding the Lyon-Meltzer drainage, and that is whether or not, following the irrigation of the region of the papilla of Vater in the duodenum with a magnesium sulphate solution, the gall bladder completely empties itself of its contents, the "B" bile of Lyon, so that the lighter colored "C" bile which follows represents pure liver bile. As we see it, one of the prime necessities of such a functional test must be that the bile collected for quantitative determination of its dye value shall be liver bile alone, and any admixture with contents from the gall bladder, or, for that matter, from the stomach or the duodenum itself, would vitiate the results. Hence, if, as Lyon assumes in the general run of cases, the gall-bladder contents are promptly and completely expelled in the A B C sequence following irrigation with the magnesium sulphate solution, so that the "C" fraction represents true liver bile, then this objection may be overruled. If, on the other hand, the "B" fraction does not represent but a variable portion of the gall-bladder contents, then any estimation of dye per unit volume of bile is in error by just so much as there is static bile delivered into the duodenum from the gall bladder during the course of the drainage.

Further objections regarding the mixing of stomach contents or of pancreatic and intestinal fluids with the discharging bile may be minimized by the thorough lavage of the stomach and duodenum prior to the injection of the dye.

Again, though to a much greater degree than in the renal test, the question of the interference of pigments with the colorimetric readings of any dye arises. Dilution gets around this difficulty in the renal functional test, but the bile pigments are not so easily disposed of, and the decolorization of bile without loss of dye represents one of the most difficult problems in essaying a quantitative determination of liver function.

Add to all these the almost certain knowledge that it is not possible to siphon over or to obtain through suction all of the duodenal contents during the course of a prolonged biliary drainage, the uncertainty of position of the tip of the duodenal tube without fluoroscopic facilities, the tendency of the tube to become clogged with extraneous material, and the great amount of individual restlessness and vagaries that crop out in a patient during such an extended procedure, and the problem which on the face of it looked simple becomes very complicated.

Following the initial work of Rountree, Whipple, and others in the use of phenoltetrachlorphthalein in a burdensome hepatic functional test involving the collection of the patient's stools for a period of 48 hours, and that of Einhorn and others in the use of the duodenal tube, but prior to the time when the Lyon-Meltzer method of biliary tract drainage began gaining prominence, McNeil undertook some investigations regarding the use of phenoltetrachlorphthalein and the duodenal tube for a liver functional test. He noted the time of appearance of the dye in the bile following its intravenous injection and the amount recovered in 2 hours. He wrote that the quantitative estimation of the dye in the duodenal contents was easily done in the same way as in the renal functional test, provided the estimation was done promptly following the collection, a statement to which we are unable to subscribe as the result of our investigations. Simply adding sodium hydroxide to even a much diluted specimen of bile did not in our experience nullify the interference of the bile pigments to a sufficient degree so that we could compare such a specimen, containing phenoltetrachlorphthalein, with a standard aqueous solution of the latter. However, McNeil came to the conclusion that the quantitative determination of the dye in the duodenal contents was of little value, a conclusion similar to that to which later workers have come.

In a series of 25 cases, we attempted to carry out biliary tract drainage and, for the sake of uniformity, we endeavored to follow the procedure outlined by Lyon exactly, but with the additional view in mind of following it up with a functional test. This consisted of waiting until the flow of the "C" fraction of bile was established, then injecting 50 milligrams of phenoltetrachlorphthalein intravenously and collecting all the bile possible during the succeeding 2 hours. In some of the more favorable cases, the typical "C" bile which Lyon describes was obtained from the duodenal tube in a fairly consistent way over such a period. On the other hand, in perhaps half the cases, for one reason or another, the flow would stop before 2 hours had elapsed, so that nothing else could be obtained from the tube without again irrigating the duodenum with the magnesium sulphate solution, a procedure which at once introduced the elements of dilution and possible gall-bladder content contamination, and thus made any comparison of the dye content of the bile with other determinations out of the question. We are familiar with the explanation which Lyon has put forth for these cases where repeated stimulations are necessary, but in some of these cases to which we refer, there was assumed to be no pathological change in the gall bladder or liver, an assumption later verified at laparotomy. Or, perhaps the tube would become obstructed and then before the obstruction could be removed, one could be sure that some of the duodenal contents had escaped down the jejunum. Furthermore, the position of the tube in the duodenum could not be accurately determined without losing part of our 2-hour period and, as Johnson has shown, siphonage or suction with the

tube tip above the papilla of Vater results in a loss of duodenal contents downward, a thing which undoubtedly, from the variable nature of our collections, occurred more than once in our series of cases.

The output of phenoltetrachlorphthalein varied greatly even in those cases in which the drainage went the smoothest. In one man no phenoltetrachlorphthalein could be demonstrated in his bile over a period of 10 days. He had a cholecystectomy for common duct and gall-bladder stones, and the determinations were attempted on the post-operative bile which drained from a tube left in the duct following the operation. At operation the liver presented no gross pathological change which could account for such a result. Microscopically, there was some increase of periportal connective tissue. The conclusion had to be drawn from this, and other cases, that there was no reasonable normal output of dye per unit of bile and time, and that on the contrary the range might be from practically nil to as high as 4 per cent in an hour. At first glance, this is not a wide variation, but in a quantitative determination of the dye, one deals with graduations of a tenth of a milligram or less, so that the range after all is too great for use. It is unfortunate that the major portion of an injection of, let us say, 50 milligrams of phenoltetrachlorphthalein is not excreted in an hour or two in the bile, as is the phenolsulphonphthalein in the urine of a normal individual, but such is the case, and this increases the difficulty of any quantitative determination.

In arriving at our quantitative values we found early that simple dilution of the collected bile with the addition of sodium hydroxide did not give us a solution which could be compared either grossly or more accurately in a Duboscq colorimeter. Accordingly, one of the first steps was to find a way of removing the bile pigments without removing the phenoltetrachlorphthalein. The common precipitants such as lead subacetate, barium hydroxide, alumina cream, egg albumin with trichloracetic acid, and others were, in general, unsatisfactory. Lead subacetate or barium hydroxide will decolorize bile so that a water-clear filtrate can be obtained, but if enough of these salts is added to throw down all the bile pigment, the phenoltetrachlorphthalein is likewise removed almost entirely.

The following procedure is the one which we finally came to use in the determinations which we made in the series as the one which did away with most of the interfering pigments and at the same time threw down the least amount of the phenoltetrachlorphthalein:

Alkalinize to a moderate degree a unit volume of the freshly collected bile (we used 25 cubic centimeters as a unit volume) and add 10 cubic centimeters of a saturated solution of lead subacetate and 10 cubic centimeters of a normal calcium chloride solution. A precipitate forms which carries down with it most of the bile pigments. This is quickly and easily centrifuged at high speed, the clear supernatant fluid poured off, made up to 250 cubic centimeters with water, and compared in a Duboscq colorimeter with a standard solution, the concentration of which is near that of the unknown.

If we are correct in our assumption that there is no difference between the phenoltetrachlorphthalein that is excreted in the bile following its intravenous injection and that which we added to plain bile in order that comparison of known amounts of the dye in bile and in water alone might be made, then the margin of error of this procedure is within 5 per cent.

Investigation on dogs was later begun with two things in view: the first to attempt the Lyon-Meltzer biliary drainage on normal and on cholecystectomized dogs; and, second, the carrying out of an hepatic functional test on normal dogs and on dogs whose liver had been damaged, as by prolonged chloroform anæsthesia.

Five dogs were anæsthetized with ether and a small stomach tube passed and guided manually into the duodenum through a laparotomy wound. The duodenum was then irrigated with a 25 per cent magnesium sulphate solution. Peristalsis was promptly inhibited almost completely, but there was no apparent contraction of the gall bladder at any time. In all our dogs, either during

digestion or in the fasting state, the gall bladder always contained a considerable quantity of bile. The recovery of bile through the tube was variable, and not suggestive at any time of an A B C sequence. Five fasting dogs were given a preliminary anæsthesia with ether until chloretone by stomach tube had taken effect, and then laparotomy and duodenotomy were done, similar to the work of Auster and Crohn. We also injected a solution of methylene blue into the distended gall bladders, and then irrigated the duodenum with a magnesium sulphate solution. In these dogs an immediate discharge of bile from the duct opening was observed as the sphincter relaxed, but at no time was there even a suggestion of the bluish gall-bladder bile. It was noted in these dogs that this discharge of bile came in spurts which were synchronous with the respirations of the animal. Since, in the dorsal position in which these dogs were lying, the gall bladder with its darker and more viscid contents was always considerably lower than the common duct opening, we sought later in six dogs to enlist the aid of gravity and found that, if, after the duodenum had been lavaged with the magnesium sulphate solution, the upper part of the dog's body was elevated in order that the gall bladder could be brought slightly above the duct opening, and if care was taken to see that there was no tension or kink in the common duct in its passage through the wall of the duodenum, in most of the dogs we obtained a play of colors in the bile appearing at the duct opening suggestive of an A B C sequence. The same phenomenon was noted when methylene blue was injected in the gall bladder. These things seem to justify Johnson's conclusion that the specimen termed gall-bladder bile is in part the result of gravity.

In two of these dogs the cystic duct was clamped off and the bile from the other biliary passages compared with that of the gall bladder. In every case that from the gall bladder was a darker color and more viscid than the bile of the hepatic ducts.

On a cholecystectomized dog, observation of the cut opening showed more or less continual leakage of bile from that point, and after irrigation with a magnesium sulphate solution and the assumption of a semierect position, there was an increase in the flow of bile, but with no gross color change. No dilatation of the stump of the cystic duct or of the hepatic ducts was found at autopsy on this dog.

In four dogs in which phenoltetrachlorphthalein was injected intravenously, it was subsequently recovered in the duodenum in from 10 to 15 minutes after injection. When the cystic duct was left patent, the dye could be demonstrated in the gall-bladder bile. When the cystic duct was clamped off prior to the injection of the dye, none could be found afterward in the gall-bladder bile. These results are similar to those of Auster and Crohn.

At no time, however, could we keep the sphincter relaxed for a 2-hour period and collect liver bile over such a period, so that it was concluded that an hepatic functional test on dogs by a method similar to that used above on humans was not feasible.

CONCLUSIONS

1. That phenoltetrachlorphthalein is not a satisfactory substance to use in an hepatic functional test based on the quantitative estimation of its output in the bile.

2. That there are too many factors which tend to prevent a complete collection of liver bile by the duodenal tube to warrant its use in such a procedure.

3. That the so-called "B" fraction in a non-surgical biliary drainage is in part at least derived by gravity from the gall bladder.

4. That under ether and chloretone anæsthesia the sphincter of Oddi will relax, but that there is no contraction of the gall bladder sufficient to empty itself concomitant with this relaxation of the sphincter as viewed at laparotomy.

5. That the intermittent flow of bile from the common duct is probably the result of an increase in intra-abdominal pressure during respiratory movements, and that in all probability, as Harer et al have concluded, "the gall bladder is emptied of its contents by pressure of adjacent, distended, and congested organs during digestion and by the milking action of the duodenal peristaltic waves."

BIBLIOGRAPHY

1. Escherich. Ueber Darmbakterien des Neugeborene und des Saueglings. Tagebl. d. Versamml. deutsch. Naturf. u. Aerzte, Strassb., 1885, lviii, 483.
2. Oddi, Ruggero. D'une disposition à sphincter speciale de l'ouverture du canal cholédoque. (Transl. from: Ann. d. Univ. libera di Perugia.). Arch. ital. de biol., Turin, 1887, viii, 317.
3. Doyon, M. De l'action exercée par le système nerveux sur l'appareil excréteur de la bile. Arch. de physiol. norm. et path., Par., 1894, vi, 19.
4. Hendricksen, W. F. A study of the musculature of the entire extrahepatic biliary system, including that of the duodenal portion of the common bile duct and of the sphincter. Bull. Johns Hopkins Hosp., 1898, ix, 221.
5. Cushing and Livingood. Contributions to the Science of Medicine Dedicated to W. H. Welch, 1900, p. 543.
6. Bainbridge and Dale. The contractile mechanism of the gall bladder and its extrinsic nervous control. J. Physiol., 1905, xxxiii, 138.
7. Barker, M. R. What is the function of the gall bladder? Med. Rec., 1907, lxxii, 555.
8. Orndorff and Black. Phenoltetrachlorphthalein and some of its derivatives. Am. Chem. J., 1909, xli, 349.
9. Abel and Rountree. On the pharmacological action of some phthaleins and their derivatives, with especial reference to their behavior as purgatives. J. Pharm. & Exper. Therap., 1910, i, 231.
10. Einhorn, M. A practical method of obtaining the duodenal contents in man. Med. Rec., 1910, lxxvii, 98.
11. Rountree and Geraghty. An experimental and clinical study of the functional activity of the kidneys by means of phenolsulphonephthalein. J. Pharm. & Exper. Therap., 1910, ii, 579.
12. Einhorn, M. Experiences with the duodenal contents. J. Am. M. Ass., 1910, lv, 6.
13. Jutte, M. E. Transduodenal lavage. Med. Rec., 1912, xcv, 543.
14. Hess, A. F. A method of obtaining cultures from the duodenum of infants. J. Infect. Dis., 1912, xi, 71.
15. Einhorn, M. New instruments for the duodenum and small intestine. Med. Rec., 1913, lxxxiii, 1119.
16. MacNeal and Chace. A contribution to the bacteriology of the duodenum. Arch. Int. Med., 1913, xii, 178.
17. Rountree, Hurwitz, and Bloomfield. An experimental and clinical study of the value of phenoltetrachlorphthalein as a test for hepatic function. Bull. Johns Hopkins Hosp., 1913, xxiv, 327.
18. Whipple, Peightal, and Clark. Tests for hepatic function under experimental conditions: phenoltetrachlorphthalein. Bull. Johns Hopkins Hosp., 1913, xxiv, 343.
19. Whipple, G. H. A test for hepatic injury: blood lipase. Bull. Johns Hopkins Hosp., 1913, xxiv, 357.
20. Whipple, Mason, and Peightal. Tests for hepatic function and disease under experimental conditions. Bull. Johns Hopkins Hosp., 1913, xxiv, 207.
21. Palefski, I. O. Visualization of the upper intestinal tract, by means of roentgen-rays in connection with the use of the improved duodenal tube. Med. Rec., 1914, lxxxv, 702.
22. McDonald, E. Treatment of the toxemia of pregnancy by the duodenal enema. Med. Rec., 1914, lxxxvi, 102.
23. Chesney, Marshall, and Rountree. Studies in liver function. J. Am. M. Ass., 1914, lxiii, 1533.
24. Einhorn, M. Direct examination of the duodenal contents (also bile) as an aid in the diagnosis of gall-bladder and pancreatic affections. Am. J. M. Sc., 1914, cxlviii, 490.
25. Okada, S. Contractile movements of the gall bladder. J. Physiol., 1915–16, l, 42.
26. Einhorn, M. The duodenal tube as a factor in the diagnosis and treatment of gall-bladder disease. J. Am. M. Ass., 1916, lxvi, 1908.
27. McNeil, H. L. The quantitative estimation of phenoltetrachlorphthalein excreted in the fresh bile of the liver. J. Lab. & Clin. Med., 1916, i, 822.
28. Judd, E. S. Changes produced by the removal of the gall bladder. Boston M. & S. J., 1916, clxxiv, 815.
29. Deaver, J. B. Cholecystostomy versus cholecystectomy. Surg., Gynec. & Obst., 1917, xxiv, 284.
30. Meltzer, S. J. The disturbance of the law of contrary innervation as a pathogenic factor in the diseases of the bile ducts and the gall bladder. Am. J. M. Sc., 1917, cliii, 469.
31. Judd and Mann. The effect of the removal of the gall bladder. Surg., Gynec. & Obst., 1917, xxiv, 437.
32. Jutte, M. E. The technique of transduodenal lavage in office practice with or without oxygen insufflation. Med. Rec., 1917, xcii, 499.
33. Nichols, H. J. Alkaline treatment of early gall-bladder carriers with observations on their detection by the aid of the duodenal tube. J. Am. M. Ass., 1917, lxviii, 958.
34. Leede, C. S. Physiology of gall bladder under normal and morbid conditions. Northwest M. J., 1917, xvi, 298.
35. Werelius, A. Suction bulb action of the gall bladder. Surg., Gynec. & Obst., 1917, xxv, 520.
36. Graham, E. A. Hepatitis; a constant accompaniment of cholecystitis. Surg., Gynec. & Obst., 1918, xxvi, 521.
37. Hemmeter, J. C. The modern treatment of gall-stone disease as affected and controlled by duodenal intubation. Med. Rec., 1918, xciv, 575.
38. Rehfuss, M. E. Medical treatment of biliary affections. Med. Clin. N. Am., 1918–19, ii, 815.
39. Einhorn, M. Direct examination of the duodenal contents in affections of the gall bladder and allied organs. Med. Rec., 1918, xciii, 885.
40. Nichols, Simmons, and Stimmel. The surgical treatment of typhoid carriers. J. Am. M. Ass., 1919, lxxiii, 680.
41. Lyon, B. B. V. Diagnosis and treatment of diseases of the gall bladder and biliary ducts. J. Am. M. Ass., 1919, lxxiii, 980.
42. Weiss, S. The duodenal tube in the diagnosis and treatment of gall-bladder and biliary disease. West. M. Times, 1919–20, xxxiv, 467.
43. Mann, F. C. A study of the tonicity of the sphincter at the duodenal end of the common bile duct with special reference to animals without a gall bladder. J. Lab. & Clin. Med., 1919, v, 107.
44. Archibald, E. Experimental production of pancreatitis in animals as result of resistance of common duct sphincter. Surg., Gynec. & Obst., 1919, xxviii, 529.
45. Loeper, M. Hemolytic jaundice. Progrès med., Par., 1919, xxxiv, 223.

46. LYON, B. B. V. A new metal tip possessing obvious advantages for use on gastric or duodenal tubes. J. Am. M. Ass., 1920, lxxiv, 246.
47. SMITHIES, FRANK. Clinical manifestations in gall-bladder disease. Northwest Med., 1920, xix, 31.
48. LYON, B. B. V. Some aspects of the diagnosis and treatment of cholecystitis and cholelithiasis. Med. Clin. N. Am., 1919–20, iii, 1253.
49. REHFUSS, M. E. Analysis of diseases of the gall bladder and ducts. Med. Clin. N. Am., 1919–20, iii, 1223.
50. HOPKINS, A. H. The treatment of catarrhal jaundice. Med. Clin., N. Am., 1919–20, iii, 1463.
51. LYON, B. B. V. The treatment of catarrhal jaundice by a rational, direct, and effective method. Am. J. M. Sc., 1920, clix, 503.
52. LYON, B. B. V. Choledochitis, cholecystitis, and cholelithiasis; the need of early diagnosis and treatment. New York M. J., 1920, cxii, 23, 56.
53. LYON, B. B. V. Diagnosis and treatment of cholecystitis and choledochitis by a method of physiological drainage. Am. J. M. Sc., 1920, clx, 515.
54. PALEFSKI, I. O. Intubation and visualization of the duodenum with the duodenal tube. J. Am. M. Ass., 1920, lxxv, 1547.
55. HENES, EDWIN, JR. The surgical treatment of typhoid carriers. J. Am. M. Ass., 1920, lxxv, 1771.
56. BROWN, G. E. The Meltzer-Lyon method in the diagnosis of infections of the biliary tract. J. Am. M. Ass., 1920, lxxv, 1414.
57. LYON, B. B. V. The need of early diagnosis and treatment of choledochitis, cholecystitis, and cholelithiasis. Ann. Med., 1920, i, 222.
58. EINHORN, M. The Duodenal Tube.
59. Editorial. Brit. M. J., 1920, Jan. 8, p. 58.
60. MACCARTHY and CORKERY. Early lesions in gall bladder. Am. J. M. Sc., 1920, clix, 646.
61. EINHORN and MEYER. Diagnosis and treatment of recurrent cholecystitis without stones. Med. Rec., 1920, xcviii, 211.
62. CHENEY, W. F. Diagnosis of gall-bladder disease. Am. J. M. Sc., 1920, clx, 469.
63. PETERMAN, PRIEST, and GRAHAM. Association of hepatitis with experimental cholecystitis and its bearing on the pathogenesis of cholecystitis in the human. Arch. Surg., 1921, ii, 92.
64. EINHORN, M. Studies on the action of various salts on the liver after their introduction into the duodenum. New York M. J., 1921, cxiii, 313.
65. SMITHIES, FRANK. Non-surgical drainage of biliary tract. Illinois M. J., 1921, xxxix, 325.
66. WHIPPLE, ALLEN O. The use of the duodenal tube in the pre-operative study of the bacteriology and pathology of the biliary tract and pancreas. Ann. Surg., 1921, lxxiii, 556.
67. LYON, B. B. V. A non-surgical method of drainage of the biliary tract as an aid in diagnosis and treatment of gall-bladder disease. Rhode Island M. J., 1921, iv, 76.
68. CROHN, REISS, and RADIN. Experiences with the Lyon test for the determination of gall-bladder disease. J. Am. M. Ass., 1921, lxxvi, 1567.
69. SACHS, A. Lyon-Meltzer gall-bladder drainage. Nebraska St. M. J., 1921, vi, 225.
70. EINHORN, M. The action of various salts and other substances on the liver after their introduction into the duodenum. New York M. J., 1921, cxiv.
71. FRIEDENWALD and MORRISON. Personal experience with non-surgical biliary drainage. New York M. J., 1921, cxiv, 280.
72. PALEFSKI, I. O. Intubation and visualization of the duodenum in suspected lesions of the pylorus, duodenum, and gall bladder. Am. J. M. Sc., 1921, clxii, 385.
73. DUNN and CONNELL. Report of a case of hepatoduodenostomy. J. Am. M. Ass., 1921, lxxvii, 1093.
74. AARON, BECK, and SCHNEIDER. The phenoltetrachlorphthalein test for liver function. J. Am. M. Ass., 1921, lxxvii, 1631.
75. BASSLER, LUCKETT, and LUTZ. Some experiences with the Meltzer-Lyon method of draining the biliary system. Am. J. M. Sc., 1921, clxii, 674.
76. AUSTER and CROHN. Note on studies in the physiology of the gall bladder. Proc. Soc. Exper. Biol. & Med., 1921, xix, 117.
77. SMITHIES, KARSHNER, and OLESON. Non-surgical drainage of the biliary tract. J. Am. M. Ass., 1921, lxxvii, 2036.
78. MCWHORTER, GOLDER L. Common bile duct sphincter. Surg., Gynec. & Obst., 1921, xxxii, 124.
79. ROUS, PEYTON, and MCMASTER. Physiological causes for varied character of stasis bile. J. Exper. Med., xxxiv, 75.
80. ROUS, PEYTON, and MCMASTER. Concentrating activity of gall bladder. J. Exper. Med., 1921, xxxiv, 47.
81. SIMON, S. H. Direct aspiration of contents of biliary tract through duodenal tube; clinical application and therapeutic possibilities of the method. South. M. J., 1921, xiv, 447.
82. LEVIN, A. L. New gastroduodenal catheter. J. Am. M. Ass., 1921, lxxvi, 1007.
83. LEVIN, A. L. Medical versus surgical treatment of gall-bladder diseases. New Orleans M. & S. J., 1921, lxxiii, 252.
84. MCLURE, WETMORE, and REYNOLDS. New methods for estimating enzymatic activities of duodenal contents of normal man. Arch. Int. Med., 1921, xxvii, 706.
85. NILES, G. M. An analysis, clinical and otherwise, of 400 non-surgical drainages of pathologic gall bladders. South. M. J., 1921, xiv, 961.
86. SYNNOTT, M. J. Survey of modern medicine; newer methods in diagnosis and therapy. J. M. Soc. New Jersey, 1921, xviii, 269.
87. PETERMAN and GRAHAM. Further observations on lymphatic origin of cholecystitis, choledochitis, and associated pancreatitis. Arch. Surg., 1922, iv, 23.
88. LYON, B. B. V. Biliary tract disease. Am. J. M. Sc., 1922, clxiii, 1 & 2, 60.
89. DOWDEN and ENFIELD. The duodenal tube in the study of liver and pancreatic pathology. South. M. J., 1922, xv, 103.
90. Editorial. Action of magnesium sulphate on the gall bladder. J. Am. M. Ass., 1922, lviii, 350.
91. WHITE, F. W. The value of medical biliary drainage for diagnosis and treatment of diseases of the gall bladder and bile ducts. Boston M. & S. J., 1922, clxxxvi, 207.
92. Editorial. The purpose of the gall bladder. J. Am. M. Ass., 1922, lxxviii, 584.
93. HARER, HARGIS, and VAN METER. Studies of the function of the gall bladder. Surg., Gynec. & Obst., 1922, xxxiv, 307.
94. JOHNSON, W. O. The function of the gall bladder with special relation to the Meltzer-Lyon test. Surg., Gynec. & Obst., 1922, xxxiv; International Abstract of Surgery, p. 177.

95. Lyon, B. B. V. Reply to certain antagonistic criticism of non-surgical biliary tract drainage. New York M. J., 1922, cxv, 269, 456.
96. McMaster, P. D. Do species lacking a gall bladder possess its functional equivalent? J. Exper. Med., 1922, xxxv, 127.
97. Kohn, L. W. A new duodenal tube. Med. Rec., 1922, ci, 499.
98. Smithies and Oleson. Diagnostic and therapeutic value of non-surgical biliary tract drainage in patients exhibiting biliary tract disease, etc. Illinois M. J., 1922, xli, 29.

HYDATID CYSTS OF THE LUNGS AND PLEURA

By DR. ROBERT HALAHAN, Buenos Aires, Argentine

HYDATID cysts of the lungs, occurring as they do, next in order of frequency to those of the liver, are of great importance. They are important, however, not so much because of their frequency as because of the very severe symptoms they produce, the complications to which they give rise, and the very serious errors of diagnosis to which they sometimes lead.

A hydatid cyst of the liver may exist for a very long time, grow to an enormous size, and still interfere but little, or not at all, with the health of the host. This is not true, however, with hydatids of the lungs. Almost from the beginning they may give rise to the most alarming and distressing symptoms, and their treatment is often a matter of great difficulty and danger. The most constant, and occasionally the earliest symptom of hydatid of the lung, is hæmoptysis, which may be great or trivial in amount. Next in importance is the cough, dry and hacking in character, and, in the early stages, unaccompanied by sputum.

In the lung, the development of the ectocyst is slight; hence rupture into the pleura or bronchi, or sometimes into both is common, and is generally fraught with great danger to the patient. Rupture into a bronchus is characterized by violent fits of coughing, cyanosis, sometimes very severe dyspnœa, invariably hæmoptysis, and, according to the size of the cyst, a greater or less amount of watery expectoration in which bits of membrane and daughter cysts are found and, under the microscope, hooklets may be discovered.

If the cyst content is not already infected when the cyst ruptures, it is sure to become so. The sputum turns purulent, hæmoptysis may be frequent and severe, hectic fever makes its appearance, and the great wasting and accompanying debility, together with the cough and sputum give the patient a typical appearance of advanced tuberculosis. Many cases have been erroneously diagnosed as such. Should the cyst rupture into the pleura, the symptoms closely simulate a pleural effusion; if the cyst is septic, an empyema. If not very carefully examined, large unruptured cysts at the base of the lung, easily mislead to a diagnosis of pleural effusion.

This much I think will show how difficult diagnosis is. I will endeavor to outline the points upon which a correct diagnosis can be made. In the first place, in any country where hydatids are known to abound, the occurrence, in an otherwise healthy person, of a dry hacking cough, with none or only scanty sputum, in which repeated examinations have failed to demonstrate tubercle bacilli or other cause, especially if there be a history of hæmoptysis, should always arouse one's suspicions of the possibility of hydatid disease of the lung. Physical examination of the chest will be fruitful or the reverse, largely according to the size and situation of the cyst. A small cyst, deeply situated, may give no physical signs at all, nor be visible in an X-ray. An examination of the blood may help. An eosinophilia is suspicious, and if the serum diagnosis of Ymaz Apathie or of Ghedine is also positive, the suspicion becomes almost a certainty. Still the case may be doubtful, and there is nothing to do but to have patience, waiting until such time as the cyst has developed to the point where diagnosis is a certainty.

If the cyst has attained a fair size, is not too deeply placed, has a circumscribed area of dullness, relative or absolute according to the amount of healthy lung tissue which intervenes between the finger and the cyst; if the breath sounds are diminished or absent, with sometimes signs of compression or of more or less acute congestion around the periphery; and if a round shadow shows on the X-ray plate, there is very little room for doubt as to the nature of the complaint, and an exploratory puncture which gives clear watery fluid, will confirm the diagnosis both as to the nature and the position of the disease. This latter procedure should be undertaken only with the patient prepared and everything ready to proceed with operation, so as to avoid a subsequent leakage of cystic contents, as sometimes the cyst content is highly toxic, or, what amounts to the same thing, some patients show a marked idiosyncrasy to it. Possibly, due to slight absorption, they have become sensitized. At any rate, serious complications have been known to follow and death has not infrequently occurred after simple puncture of a hydatid cyst; hence the necessity for exercising all due caution. Furthermore, secondary infection is almost certain to follow, with all its attendant dangers. Though hydatid cysts of the lungs sometimes undergo spontaneous cure, once the diagnosis has been established, if the cyst is at all accessible, there can be no doubt that bold surgical intervention offers the best chance of effecting a cure, and, in not a few cases, the only chance. But its accomplishment is by no means always either easy or simple.

On general principles the cyst should be approached from the nearest point on the surface. This point can be determined in two ways: first, by examining the patient with the fluorescent screen—the nearer the cyst to the tube the bigger will be the shadow it will cast; second, by locating the cyst with the exploring syringe. A generous resection of the rib, or ribs as the case may be, will greatly facilitate. It is almost useless to try to avoid the occurrence of pneumothorax, as with each inspiration one hears the sizzle of air entering the thorax, no matter how carefully the stitching is done. Long before the experience in the war demonstrated the fact generally, those of us who were accustomed to open the thorax for the treatment of conditions either in it or in the subdiaphragmatic region, had learned to look on pneumothorax in fairly healthy subjects as a very benign condition. It is very important, however, to use some means to fix the lung, so as to prevent the region to be treated from getting out of control by retracting deeply within the thorax. The best means I know of to accomplish this is to pass a large curved needle, armed with strong catgut, through the intercostal muscle and the still unopened pleura deep into the lung tissue. If it is not passed through the muscle it is apt to tear out. It should be passed on the side of the wound nearest the root of the lung, as when the pleura is opened the lung will retract toward the root. The pleura is now widely opened, the position of the cyst again verified with the exploring syringe, and the cyst opened. As a rule no difficulty is experienced in removing the endocyst, and as the development of the ectocyst in the lung is very slight, the cavity left has an extraordinary resemblance to normal pleura. The cut margin of the lung tissue is fixed to the margins of the wound by catgut sutures, the tension of which is regulated to control the sometimes rather free, but not very high pressured, bleeding. If the lung has not been well fixed, and the opened cyst should escape into the depths of the thorax, the search for it will, I think, provide the most enterprising surgeon with all the surgical thrill he is likely to want for that day.

Sometimes the opening of the cyst is accompanied by violent coughing, and with each cough there is a splutter from the wound of blood and hydatid contents, of which the surgeon as a rule receives his due share, and the patient sometimes becomes alarmingly cyanosed. In a very short time the lung seems to accommodate itself, the cyanosis passes off, the breathing becomes regular, but the cough may prove troublesome for some days. It then generally passes off, and oftentimes at the end of a week it has disappeared for good, to the immense relief of the patient.

The subsequent treatment consists in keeping drainage well established, in giving a good

nourishing diet, in getting the patient up early, having him take deep-breathing exercises and other moderate exercises and be in the sunshine as much as possible. This method soon effects a cure. Appended are a few short notes of some cases that have been under my care in the British Hospital.

CASE 1. Hydatid of pleura, suppurating and ruptured, simulating empyema. I was called one night to see a lady who presented all the signs of an empyema. As I happened to have an aspirator with me I decided to aspirate the chest to relieve the pressure symptoms. About a litre of pus was drawn off. The next morning a rib was excised, and on opening the pleura, a hydatid cyst popped out. The pleura was drained and the patient did well for 48 hours. A urticarial rash appeared, the patient became more and more collapsed and died 12 hours later.

CASE 2. Hydatid of lung, ruptured into bronchus. A man, 48 years old, complained of distress which began 7 years before, with cough and hæmoptysis followed by copious sputum and frequent and severe hæmorrhages. He had alternate attacks of fever, loss of appetite and flesh, with periods of more or less good health between when he gained in weight and was able to carry on his work as a stevedore. He is rather given to the use of alcohol. Patient was first seen 4 years ago. He is still alive and at present comparatively well. He has often spat up almost a basin full, and on several occasions bits of membrane. He recently came for treatment of another condition and is at present in the hospital. His old symptoms have almost entirely disappeared. The cough has ceased for some months, and he has gained several kilos in weight; apparently a spontaneous cure. Since the above was written this patient returned to the hospital with severe pulmonary symptoms, and subsequently died of gangrene of the lung.

CASE 3. Hydatid cyst of the pleura. Girl, 14 years old, was operated on 5 years ago for hydatid of the liver. On the right side in front, absolute dullness reached from the clavicle to the sixth rib, and extended outward from the middle line to the mid-axillary line. X-ray showed a round shadow, much bigger when examined with the patient facing the tube than when she had her back to it. No breath sounds were present over the dull area. There was a patch of pneumonia in the left base, and the patient had a high temperature. As suppuration was suspected in the cyst, operation was immediately undertaken. Three and a half inches of the third rib were excised, and the lung was fixed and the pleura opened. The cyst, about the size of an orange, came away from a cavity. So thin was the ectocyst that the lining membrane seemed to be of normal pleura. Five weeks later, after a rather stormy time, an empyema developed on the other side. This was opened and drained in the usual way, and the patient left the hospital completely cured, in 4 months.

CASE 4. Hydatid of the lung, rupture into bronchi and pleura simulating tuberculosis. Boy, 10 years old, was admitted with a pyopneumothorax of the left side. He presented the typical appearance of advanced tuberculosis. Thoracotomy revealed a large cyst in the base of the lung, which had ruptured both into the bronchi and the pleura. Free drainage was established and the boy completely recovered, in 3 months.

CASE 5. Hydatid of the base of the lung, simulating pleural effusion. Woman, 27 years old, was ill for 3 months. She presented signs of a large pleural effusion on the left side, but had a marked bulging of the ribs and a very troublesome cough, with scanty but blood-stained sputum. X-ray showed a very dense shadow of the base of the lung. The heart was greatly displaced to the right. Extensive resection of the rib was done, the cyst was opened, free drainage established, and the patient left the hospital cured, in 3 months. Three days after the operation the cough had entirely disappeared.

ACUTE SUPPURATIVE PLEURISY

An Analysis of Ninety-Four Cases

By CHARLES H. PECK, M.D., F.A.C.S., and HENRY W. CAVE, M.D., F.A.C.S., New York

THIS paper is based upon an analysis of 94 cases of acute suppurative pleurisy, treated upon the Surgical Services at the Roosevelt Hospital, from January 1, 1915, to January 1, 1920, a period of 5 years. Only eleven of these were postinfluenzal, the remainder being postpneumonic. In this respect the material in this study differs from that contained in many of the recent, exhaustive, war-time reports.

The condition is usually secondary to pneumonia, either of the pneumococcic or streptococcic type: in adults, most often a lobar pneumonia; in children, frequently a bronchopneumonia. In certain cases it is impossible definitely to demonstrate a pre-existing pneumonia.

Barjon's (1) idea that empyema usually originates in an infection of mediastinal lymph nodes, with dissemination through the interlobar spaces of the pleural cavity, while an interesting theory, still lacks confirmation as a pre-eminent etiological factor.

In the bacteriological study of our series, we found the pneumococcus present in 33 of the 94 cases. Grouping was done in only 22 of these cases with the following results:

	Cases
Group I	7
Group II	2
Group III	5
Group IV	8

The streptococcus was isolated in 10 cases: staphylococcus in 5, and mixed infection in 5. Our records are incomplete as to culture in the remainder and of those in which the cultures proved sterile. In 77 of the cases the exudate was of the classical, thick, purulent variety; in 10 seropurulent; and in 7 the character was not noted.

The exudate of the pneumococcus contains more fibrin, is usually more quickly walled off, and somewhat less abundant than that of the streptococcus, which is prone to produce a thinner generalized exudate of large amount. This fact becomes of great importance in considering the dangers of open, sucking, pneumothorax following early operation for empyema of the streptococcic type.

Butler's (2) notation that in civil life the pneumococcus is found twice as frequently as the streptococcus, is borne out by our own experience. He states that these two organisms are the causative factors in 75 per cent of cases in civil practice, whereas in military life approximately 80 per cent of the post-pneumonic cases were due to the streptococcus alone.

Lord (3) in an analysis of 200 cases found the pneumococcus in 39.4 per cent, streptococcus in 20.4 per cent, staphylococcus in 3.6 per cent, mixed infection in 16 per cent, and in 18.2 per cent the cultures were sterile.

Other occasional etiological factors, such as penetrating wounds, or chest-wall injuries, suppurative disease of the mediastinum or adjacent viscera, etc., do not appear in this series, with the exception of 3 cases, secondary to lung abscess. In one case of pneumococcus empyema, pulmonary tuberculosis had pre-existed for 11 months. The following are some observations brought out in the study of the series: There were 62 males. 32 females. The average age was 20.4 years. The oldest patient was 52 years. The youngest patient was 9 months. The average time from the onset of the illness to the day when the diagnosis of empyema was made was 38.2 days.

69 cases were postpneumonic.

11 cases were postinfluenzal.

3 cases were secondary to lung abscess.

In 11 cases the pre-existing cause was undetermined.

34 cases were on the right side.

52 cases were on the left side.

In 8 cases the location was not noted.

18 were in the upper half of the chest.

70 were in the lower part of the chest.

60 were localized.
17 were general.
5 were interlobar or sacculated.

No case of bilateral empyema was noted in this series.

Roentgenographic studies were made in many of the cases and were often of great value, but were not sufficient in number to present in statistical form.

In considering symptoms and signs, a delayed convalescence following pneumonia or influenza, with recrudescence or persistence of fever and signs of sepsis, should always suggest the possible development of empyema. The usual physical signs of fluid, localized or general, confirmed by roentgenography, fluoroscopy or aspiration, should soon establish a positive diagnosis.

Several cases of the localized and sacculated type presented interesting problems in diagnosis and treatment; two were high up beneath the left scapula, posteriorly; two presented multiple sacculations.

The treatment of empyema by drainage is one of the oldest operations of surgery. Many efforts have been made to simplify this procedure by substituting less radical treatment. A notable example is the formalin-glycerine injection method so strongly advocated by the late J. B. Murphy (4), which has failed to fulfill its early expectations as a substitute for drainage.

Simple aspiration, repeated, is valuable as a pre-operative procedure, to tide over critically ill cases to a period safer for radical operation; and in a small percentage of cases, especially in children, will effect a permanent cure in itself. We have had no cures in this series by aspiration *per se*, but have employed it as a preliminary to radical operation in several instances with excellent result.

The same may be said of the minor procedures of inserting small cannulæ or tubes through trocar wounds in the intercostal spaces, which we have also done a few times. These less radical procedures are especially valuable in generalized empyema of the streptococcic or postinfluenzal types, in the early stages when constitutional symptoms are severe and the margin of safety is narrow. They are also useful in severe early cases of the pneumonic type, during the period when radical operation is perilous. An illustrative case was one of pre-existing cardiac disease with marked decompensation and great dyspnœic distress, which was temporarily drained by trocar puncture and a small intercostal tube, until improvement warranted radical drainage, 8 days later, with ultimate cure. We have employed irrigations with Dakin's solution in a few such cases to prevent clogging of the small tube and facilitate drainage. This method, originated by Mozingo (5), which we have found so useful as a temporary procedure, we have not succeeded in carrying through to a complete cure of the condition, but have not, perhaps, persisted long enough in the effort to give it a thorough trial. Neither have we used Dakin's irrigations through the small tubes, with the idea of effecting complete sterilization of the cavity in acute cases; though we have used it for this purpose in three instances, in later stages after thoracotomy and drainage.

Some newer methods worthy of mention, with which we have had no personal experience, are the "tidal irrigation" of Taylor (6) of Toronto; the negative pressure closed method of Brix (7); the oblique intercostal incision with valve-flap action, etc.

Open intercostal tube drainage without rib resection, was employed in 15 cases, with 5 deaths; this group representing critically ill cases unsuitable for more radical operation. Local anæsthesia was used in 14 of these cases.

Instead of using an incision parallel to the ribs, Morison (9) has suggested a vertical incision down to the ribs and across the intercostal space, with the idea of preventing kinking of the tube by respiratory movement and change of position.

Rib resection was employed in 79 of our series, in the majority of cases using the eighth rib in the posterior axillary line.

In the earlier cases of the series the Brewer spool with siphon bottles or the Connell suction apparatus was the method of choice. Later, on the Second Surgical Division, the following procedure has been adopted as a routine: A large firm rubber tube, three-fourths inch in diameter and about 6 to 8 inches

long, projecting 1 to 2 inches into the pleural cavity, is anchored in position by suture. Gauze plugs on either side and careful suture of the wound angles tend to prevent sucking of air around the tube. The end of the tube is immediately clamped; a small split compress around the tube is at once strapped tightly to the chest wall with adhesive plaster carefully fitted, to complete the air-tight joint. A flange of rubber dam through which the tube passes may be used beneath the strapping to effect a more perfect closure. Gauze pads held by a binder, complete the dressing. On return to the ward a long tube of smaller caliber, with its end submerged in solution in a large bottle on the floor at the side of the bed is attached to the large drainage tube by a tapered glass connection. Each inspiration tends to draw a column of fluid up in the tube producing a degree of negative pressure in the pleural cavity. Assuming that an air-tight joint has been secured, no air can enter the chest through or around the tube. Pus from the cavity flows into the bottle and settles at the bottom. Change of the fluid once or twice a day is sufficient, the tube being clamped each time. The amount of pus diminishes rapidly from day to day, and as a rule there is little or no soiling of the gauze dressing on the chest wall. We have repeatedly found it unnecessary to change it for a full week. Offensive pus-soaked dressings are practically eliminated by this method. If the attempt to secure an air-tight joint has failed, complete change of the dressing down to the chest wall and readjustment of the strapping will usually overcome the difficulty.

After the fourth or fifth day the patient is put on Wolff blow bottles, and encouraged to use deep breathing to expand the lung. At from 7 to 10 days the air-tight drainage has usually accomplished its purpose, the pleural adhesion to the chest wall has progressed to a point eliminating danger of lung collapse. The original tube is removed and replaced by one smaller, but still of good size; e.g., one-half inch diameter, which is cut short and covered by fluff gauze. Within the next week the cavity has as a rule become a simple tube tract. Tubes progressively shorter and of smaller caliber are used until the tract is simply a thoracic wall sinus.

Throughout the treatment care must be taken to prevent unrecognized plugging of the tube or the formation of lateral pockets. In the later convalescence, balcony treatment, deep breathing and chest and arm exercises are insisted upon.

We have not employed the method of open drainage with Dakin irrigation of the cavity, so widely used during the war, sufficiently to express an opinion as to its value, but feel that the method described has given quite as satisfactory results, both as to percentage of recoveries and time of convalescence.

We have used local novocaine analgesia in 54 cases and consider this the method of choice, especially in critically ill cases. General anæsthesia, open drop ether was employed 35 times, sometimes combined with local, to minimize the amount required. In children general anæsthesia is usually necessary.

We cannot claim a mortality to compare with the 4.3 per cent of the Empyema Commission (8), but have not attempted to exclude deaths really due to the pre-existent pneumonia.

Eighteen of the 94 cases died in the hospital, a mortality of 19.1 per cent. Three deaths attributed to operative shock may well have been due to the existing pneumonia. Two died of pneumonia of the opposite lung. Two of cerebral embolism. In 9 death was attributed to sepsis and exhaustion, pneumonia probably being an important factor in some of this group. In 2 cases the cause of death was not stated.

Hæmorrhage from intercostal vessels did not occur in this series, but in a recent case, an elderly debilitated patient, death occurred from this cause, 9 days after operation, after removal of the drainage tube.

Of the remaining 76 cases, late results are known in 60 (76.3 per cent). Forty-nine cases healed completely, and have remained closed, the average time being 9.1 weeks.

In 11 cases secondary abscess required opening. One of these has been operated upon three times and still has a discharging sinus. Two of the secondary operations were done elsewhere.

Another case operated upon July 1, 1917, developed a secondary abscess in February, 1921, and still has an unhealed sinus. Another case broke open 14 months after primary closure, final healing being complete in 8 months. Eight cases reported secondary operations, three of which healed within 1 year, 5 within 2 months after the secondary operation.

SUMMARY

Total cases treated 94
Mortality (18 cases) ..... 19.1 per cent
Closed and remained closed. 49 cases of the 60 (80.1 per cent) (average time 9.1 weeks) (late reports)
Persistent sinuses and secondary operations ..... 11 cases

No attempt has been made in this paper to deal with the special problems arising in the management of chronic, late, or neglected cases of empyema as these form a distinct group in themselves.

CONCLUSIONS

1. The successful treatment of acute empyema is still based upon measures which provide adequate drainage.

2. The principle of air-tight drainage, avoiding an open, sucking pneumothorax, with moderate negative pressure to keep the cavity constantly empty, is of primary importance, and favors the rapid diminution of the size of the cavity until it becomes a simple tube tract. It is one of the greatest recent improvements in the management of these cases.

3. Palliative pre-operative measures, e.g., repeated tapping, are important in the early stage of severe cases, especially those of the postinfluenzal or streptococcic types, or when pneumonia is not completely resolved, radical operation being postponed pending improvement in the general condition.

4. Closed tube drainage by the method described compares favorably in results as to recovery and time of healing, with the method of immediately dakinizing the cavity for the purpose of sterilizing it. Early bacteriological examination is of aid in determining the prognosis and plan of operative procedure.

5. The use of roentgenography and fluoroscopy is of great value in determining the position and extent of the exudate.

6. Local analgesia is the method of choice except in children where open drop ether may be necessary.

7. Improvement in constitutional symptoms following operation for postpneumonic cases in our series was usually prompt; while in postinfluenzal cases 4 or 5 days elapsed before similar improvement was attained.

8. Balcony treatment, blow bottles, deep breathing, and chest and arm exercises should be instituted early in the convalescence.

REFERENCES

1. Barjon. Radio diagnosteques—pleuro-pulmoniese. Paris: Masson et Cie, 1920.
2. Butler. Mil. Surg., 1921, April.
3. Lord. Modern Medicine (Osler and McCrae). 2d ed. 1914, 1004-1070.
4. Murphy. Surg. Sect. A.M.A. Ass., 1909, discussion of Meyer's paper. Quoted in Keene's Surgery, vol. 1, 1909.
5. Mozingo. J. Am. M. Ass., 1918, lxxi, 25.
6. Taylor. J. Am. M. Ass., 1921, lxxvii, No. 18.
7. Brix. (N. O. Rammstedt.) J.-Lancet, 1921, xli, 597.
8. Empyema Commission. J. Am. M. Ass., 1918, lxxi, 5.
9. Morison. Med. Ann., 1910; General Surgery, Morison, vol. 1, 252.

HYPOPHYSEAL DUCT TUMOR IN A CHILD OF TEN[1]

By THOMAS H. LANMAN, M.D., Boston
Clinical Assistant Surgeon, Children's Hospital
AND
LAWRENCE WELD SMITH, M.D., Boston
Instructor in Pathology, Harvard Medical School

TUMORS of the hypophyseal duct are still of sufficient rarity to warrant their being reported. The following case occurred on the Surgical Service of the Children's Hospital in Boston. The relative infrequency of these squamous-cell tumors is seen by the fact that in Cushing's work, reported in 1912 (2), only two authentic cases are recorded. It adds one case to the thirty-eight originally reported by Jackson (7, 8) in 1916, the seventeen additional ones reported by Duffy (3) in 1920, and the three reported by Bailey (1) in 1921.

Marjorie W., aged 10 years, 7 months. Children's Hospital No. A-39591. Admitted July 5, 1921.

The father and mother are living and well. There is one other younger sister who is living and well. There is no history of miscarriage or of tuberculosis.

The child was a full term baby and was normally delivered. She had a normal feeding history. At about 5 years she had measles, and a short time later this was followed by pertussis. Aside from these two contagious diseases, there is no past history of any illness or trauma to suspect as an etiological factor in the present illness.

Present illness. About 7 months ago the child began to have occasional attacks of vomiting accompanied by a moderate fever and pronounced constipation. These attacks increased in frequency since that time. The child was admitted to the hospital with a diagnosis of subacute appendicitis following one of these attacks of fever, constipation, and vomiting 10 days ago. There has been very little abdominal pain except on defæcation.

Physical examination. The head is of normal contour. The pupils are equal and react to light and distance. The extra-ocular movements are normal. The corneæ, sclera, and conjunctivæ are clear. The nose and throat are negative. The chest is symmetrical, well developed, expansion equal. The lungs are clear throughout. There is no dulness; no râles or changes in breath sounds are heard. The heart is not enlarged, its action is regular and of good quality. The abdomen is slightly tender all over. The entire colon is readily palpable, and is filled with fæcal masses. No true spasm is obtained. There is no localized tenderness.

Operation, July 6, 1921. Simple appendectomy under ether anæsthesia. Recovery was normal and uneventful and without rise of pulse or temperature. Examination of the appendix showed some slight thickening of the wall microscopically.

July 8, 1921. Two days following operation the child vomited. Vomiting was not definitely projectile. The child appeared drowsy as if tired out, and was aroused with some difficulty. Physical examination essentially negative, as noted before.

July 8, 1921. The child made a normal recovery following operation, but still showed the same symptoms of occasional attacks of nausea and vomiting accompanied by moderate fever and constipation. In view of this circumstance more complete data concerning the earlier history were obtained. It was found that she had had trouble with her eyes for slightly over 2 years. In school she had difficulty with her vision and was seen by an ophthalmologist who fitted her with glasses. Following this there was temporary improvement. The family physician thought at that time that these visual disturbances might be associated with kidney lesions, but none were ever definitely found. During the summer of 1919 the child was under the care of a children's specialist who considered this visual defect one of nervous origin which she would probably outgrow. She was examined carefully at the Eye and Ear Infirmary in the fall of 1919, and only mild refractive errors were noted. Again in November, 1920, she was re-examined at the Eye and Ear Infirmary and similar refractive errors found. Nothing abnormal was noted at these examinations about her fundi. In December, 1920, she began having abdominal pain, as noted in the earlier history, accompanied by headache, rise in temperature, and vomiting of a semiprojectile character five or six times at 10 or 15 minute intervals. The vomiting was usually relieved by enemeta. Following one of these attacks she would be drowsy for several days. She was bothered considerably by an obstinate constipation which did not yield to the usual drug treatments. At that time she was put on a strict diet and given careful directions concerning personal hygiene. She had no trouble for 3 months, and then in March, 1921, had a similar attack. At that time X-ray of the gastro-intestinal tract showed a long kinked appendix, and since that time these attacks have been attributed to that recognizable pathological lesion.

(Dr. Bronson Crothers.) *Neurological consultation.* The examination proved to be negative except for the eyes. The pupils were found to be slightly dilated, of equal size, and they reacted to light and

[1] From the Surgical and Pathological Services of the Children's Hospital and the Pathological Laboratories of the Harvard Medical School.

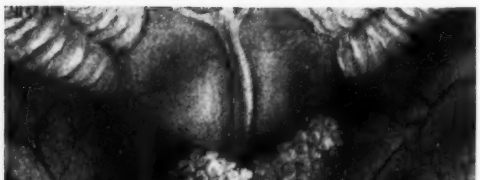


Fig. 1. Hypophyseal duct tumor from below. Note compression of optic chiasm and invasion of third ventricle. The polycystic nature of the tumor is evident from the verrucous-appearing surface. Blood supply from the vertebral vessels.

distance. The fundi both showed some slight blurring of the edges of the discs, but there was no true choking. The blurring was not sufficient to be inconsistent with marked refractive errors. Question of a cerebral lesion, possibly a tumor, was raised at this time, but on the basis of the physical examination could not be definitely proven. She was seen again in consultation, and nothing additional or definite was found in the fundi to establish a diagnosis of cerebral tumor. X-ray examination (Dr. Percy Brown) of the sinuses was negative.

Ophthalmological consultation. July 23, 1921. There is a swelling of both discs of about 5 diopters, with tortuous vessels. There are no hæmorrhages. The macular region is normal. There is slight divergence of the left eye which is due to pressure. The visual fields are difficult to obtain and suggest a bitemporal hemianopsia. X-ray examination of the sella is said to be normal, but the posterior wall looks somewhat indefinite. Lumbar puncture shows increased pressure, but is otherwise negative.

July 25, 1921. X-ray examination of the head. Ventriculograms with air injection under an anæsthesia show greatly dilated ventricles laterally. The third ventricle is not outlined. Cerebellar decompression advised.

July 27, 1921. Cerebellar decompression under ether anæsthesia. The patient is put on her face and a cross-bow incision made over the cerebellar region. The decompression is made sufficiently wide to expose the foramen magnum. The cerebellum is found to be tense. The ventricles are tapped and found to be under greatly increased pressure. The dura mater is opened and the cerebellum explored. No tumor is found. There is no block in the aqueduct of sylvius, as fluid injected into the lateral ventricle comes out through the aqueduct. There is no evidence of a cyst. The dura is closed and the skin sutured. The child is in poor condition at the end of the operation. About an hour after operation the child went into shock with complete collapse and died. Postmortem examination obtained within 4 hours of death.

Autopsy. Marjorie W., 10 years, 7 months. 4 hours post mortem. (Autopsy restricted to head.)

Diagnosis. Cystic hypophyseal duct adamantinoma of squamous epithelial cell rest origin.

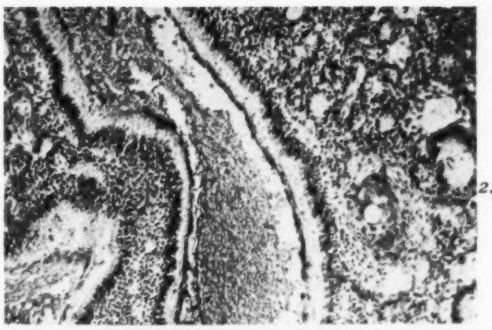
Head. The head is of normal contour. It is completely shaven and presents two surgical incisions, one over the right temporal bone which has healed by first intention, and a second over the occiput in the form of a large T. This incision has been extended laterally in order to reflect the scalp over the calvarium. Under this posterior T-incision is an area of decompression which exposes the meninges over the cerebellum. Over the right temporal area, there is a small decompression trephine which appears clean. The calvarium is removed by connecting these decompression trephine openings. The dura is markedly injected, but shows no evidence of any infection. It contains over the occipital area sutures which show no evidence of secondary infection. The dura is removed by parallel incisions along the falx cerebri which is cut through anteriorly and the falx removed. The longitudinal sinus appears normal. The tentorium is incised along the temporal bone. The anterior lobes of the brain are lifted and expose a tumor mass lying between the olfactory nerves and obliterating from view the optic chiasm. (Fig. 1.)

This growth is covered by normal appearing pia-arachnoid. It is about the size of a large walnut, rather lobulated in appearance, with numerous verrucous-like projections on its surface. It is grayish white in color and appears to be definitely associated with the pituitary body. The brain, with the pituitary, is removed *in toto*. No lesions of the brain itself are noted in the gross. The tumor mass occupies the space between the optic chiasm and the infundibular stalk, to which it appears attached. In removing the hypophysis it is noted that the sella has undergone definite atrophy and destruction of its posterior wall. The tumor is cystic in appearance and somewhat fluctuant on palpation. One lobe of the tumor occupies definitely a portion of the sella and seems to arise from the anterior portion of the gland. The posterior portion of the pituitary appears normal. The tumor has grown down into the space normally occupied by the third ventricle, has partially occluded the foramina of Munro, and caused

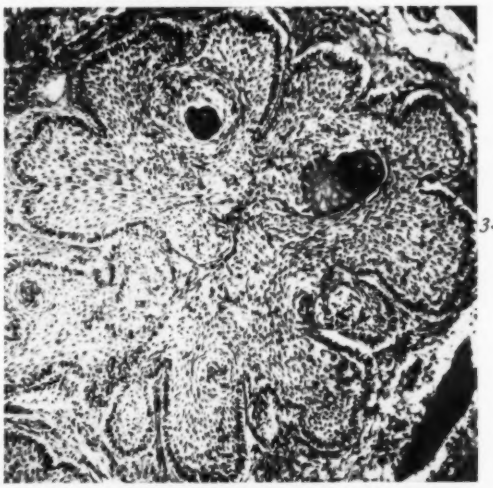
slight internal hydrocephalus. There is no actual attachment, however, at any point to the cerebral tissue, and whatever pathology is present is due to direct mechanical pressure. The tumor is removed by dissecting away the arachnoid. It is cut in half, one-half being preserved in formalin, the other sectioned and fixed in Zenker's fluid. The appearance in the gross suggests a pituitary tumor arising from the anterior lobe except for its cystic appearance. It measures 5 by 4 by 4 centimeters before sectioning. There is one large cyst which occupies about a third of the tumor mass in the deeper portion of the tumor found in the third ventricle. The cut surface of the tumor presents a somewhat adenomatous appearance, with grayish white stroma, in which are yellowish gray masses of tissue, almost suggesting adenomata. No absolute etiology of the tumor can be made out from its study in the gross, but it most strongly suggests an anterior lobe origin.

Microscopical examination. Microscopically the tumor presents the same general structure throughout. It is essentially an epithelial tumor with an adenomatous-appearing arrangement of its cells, presenting numerous nodules with a markedly arborescent tendency. They grow in trabeculæ, which in turn spread out and form many branching lobules.

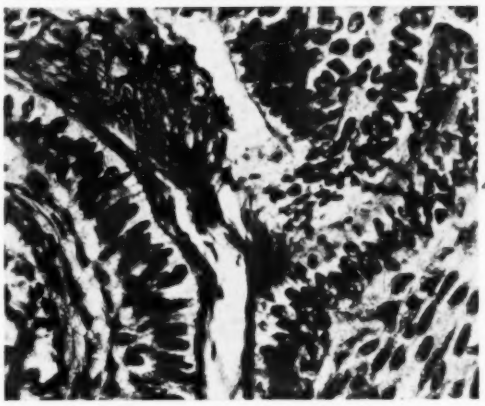
These masses of cells as shown in Figures 2, 3, and 4 are of a rather high cylindrical type. They present a basement membrane externally, and centrally contain a loose stroma of cells which have interlacing fibrils. In many places these cells tend to become concentrically arranged, forming pseudo-epithelial pearls, and thus establishing their epithelial origin. No actual keratinization is noted. Many of these pseudo-pearls have accumulated lime salts and are undergoing definite calcification. In places the tumor grows in solid cords which tend to spread apart and become cystic centrally, with a single layer of columnar epithelium lining them. Such a picture is presented by the wall of the large cyst which was noted in the gross. This epithelium varies from high columnar to a relatively low cuboidal, and presents in many places a pseudo-stratification. The cells making up the stroma of these adenomatous evaginations are in places difficult to distinguish from fibrous-tissue cells except by differential stains. The nuclei tend to become oval and the intercellular substance resembles closely the collagen and fibroglia fibers of connective tissue. One section of the tumor shows an interesting arrangement of the tumor cells, forming one of the cysts previously noted. It is filled with a homogeneous pink-staining material, which appears



2.



3.



4.

Fig. 2. Photomicrograph, low power, showing a true adamantinoma arising from the jaw. Note the reversal of the nuclear arrangement of the basal layer, with the cytoplasm toward the cystic portion of the tumor.

Fig. 3. Low power photomicrograph of the tumor. Note the arrangement of the cells of the basal layer, the nuclei arranged toward the cystic central portion of the tumor. Also note the squamous cells tending to cornify and undergo calcification.

Fig. 4. High power photomicrograph of the same. The epithelial character of the cells is apparent.

to be mucinous in character. At the periphery of this cyst are numerous groups of cells, apparently budding from this single layer of lining epithelium. These buds in turn extend into the stroma of the tumor, forming other smaller cystic areas or similar arborescent nodules previously described. The stroma of the tumor is composed of a delicate fibrous-tissue reticulum in which some focal areas of hæmorrhage have occurred, with necrosis of the tissue. There is nowhere in the actual tumor any evidence of pituitary body cells. At the periphery of the tumor in certain of the sections there are normal appearing anterior lobe cells. These are separated from the tumor by a dense connective-tissue layer which seems definitely to preclude any association of the origin of the tumor from either lobe of the pituitary. The character of the epithelium of this tumor, with its adamantinomatous appearance, suggests strongly the origin of the tumor from hypophyseal duct rests.

EMBRYOLOGY AND ETIOLOGY

Duffy (3), in his admirable article upon hypophyseal duct tumors, has discussed the embryology in great detail, reporting the earlier work of Erdheim (4, 5) and other anatomists. Briefly, the hypophyseal duct and the hypophyseal vesicle or Rathke's cleft, develop independently of one another. The latter is a normal finding in early adult life and consists of a slit-like fissure lined by a single layer of cylindrical epithelium. From this cleft arise the simple cysts of the hypophysis. The hypophyseal duct, on the other hand, consists of a modified squamous epithelium which gradually becomes cubical and merges with the epithelium of the buccal cavity. This duct retrogresses, and by adult life should be completely obliterated. Erdheim, however, has demonstrated persistent fœtal inclusions in the region of the hypophysis, which usually occur at the "insertion of the erstwhile hypophyseal duct which is carried upward by the further rotation of the developing gland to the anterior infundibula and the upper pars anterior surfaces." Again, the so-called pharyngeal or accessory hypophyses, which are so conspicuous in certain of the lower vertebrates, may persist in man, and again give rise, as fœtal inclusions, to tumors in later life. "It seems evident that the entire region of the hypophysis, from the pharynx to the processus lingualis of the pars intermedia, is peculiarly rich in vestigial reliquiæ which may be considered as possessing both function and tumor-producing possibilities." (Duffy.)

CLASSIFICATION

Duffy has followed the usual classification of tumors of this region into three chief groups, all falling under the general heading of heterogeneous hypophyseal tumors, in other words tumors arising from cells playing no part in the actual glandular tissue. They are subdivided into (a) simple epithelial cysts, usually of a papillary character; (b) the somewhat complex adamantinomatous-appearing tumors, the so-called "autochthonous teratoids developing by metaplasia from hypophyseal duct remnants" (Ewing, 6), and it is in this larger group of cases that the report is included; (c) the group including the true teratomata with cells of all three germ layers, and likewise the rare malignant cases which, as reported by Duffy, number only five.

The case reported here is quite comparable to Duffy's Case 2, a summary of which is presented.

A girl of 11, with a history of headaches for 5 years, and excrescence of sex features since the age of 9. There has been progressive failure of vision for 1 year and projectile vomiting for 8 months. A cystic suprasellar tumor was evacuated at operation. Microscopic examination showed a characteristic adamantinomatous tumor developing from an infundibular squamous epithelial rest of the hypophysis. The child died and no autopsy was obtained.

Again Case 2, reported by Bailey, is somewhat comparable to the present one, occurring in a young boy of 11, a cyst evacuated by operation, and secondary meningitis followed by death. An autopsy was obtained, and a typical cystic epithelial adamantinoma found.

The nomenclature seems to have become generally accepted following a period of over 20 years, in which many confusing terms are found in the literature. Among these may be mentioned the ependymal papilloma, the papilloma of the choroid plexus, cystic pial endothelioma, and the craniopharyngeal duct tumor. This latter term is practically synonymous with the hypophyseal duct tumor which is most frequently applied at the present time to these tumors.

DIAGNOSIS AND PROGNOSIS

Duffy in particular feels that X-ray examination of the head is of great value in establishing a definite diagnosis, as these tumors are usually found just behind the optic chiasm, usually above the sella, although they frequently invade it. The presence of calcified nodules in a suprasellar position is almost in itself diagnostic. The chief difficulty is in differentiating these tumors from true teratomata or dermoids before operation. The latter, however, are much less common and offer an equally poor prognosis. Only one case thus far is on record of recovery following operation.

SUMMARY

A case of hypophyseal duct tumor in a child of 10, showing symptoms for slightly over 1 year, is presented. A discussion of the embryology and etiology is given, emphasizing the importance of the vestigial reliquiæ of the embryological hypophyseal duct.

BIBLIOGRAPHY

1. Bailey, P. A note concerning keratin and keratohyalin in tumors of the hypophyseal duct. Ann. Surg., 1921, lxxiv, 501.
2. Cushing, Harvey. The Pituitary Body and Its Disorders. Philadelphia: J. B. Lippincott & Co., 1912.
3. Duffy, W. C. Hypophyseal duct tumors. Ann. Surg., 1920, lxxii, 526 and 725.
4. Erdheim, J. Ueber Hypophysenganggeschwuelste und Hirncholesteatome. Sitzungsb. d. k. Akad. d. Wissensch., Math.-naturw. Cl., Wien, 1902, cxiii, 537.
5. Erdheim, J. Ueber einen neuen Fall von Hypophysenganggeschwulst. Zentralbl. f. allg. Path. u. path. Anat., 1906, 17, 209.
6. Ewing, J. Neoplastic Diseases. Philadelphia: 1919.
7. Jackson, H. Craniopharyngeal duct tumors. J. Am. M. Ass., 1916, lxvi, 1083.
8. Kanavel, A. B., and Jackson, H. Cysts of the hypophysis. Surg., Gynec. & Obst., 1918, xxvi, 61.

LYMPHATICOSTOMY IN PERITONITIS

By W. A. COSTAIN, M.B., Toronto, Ontario
Department of Surgery, University of Toronto

In November, 1922, I published the results of experimental research which go to show that there is a fatal absorption through the thoracic duct in diffuse septic peritonitis (1).

The problem was attacked from a purely surgical point of view, it being assumed that before a study of absorption could be conducted a true diffuse septic peritonitis would have to be set up in the animal and the peritonitis would have to be uniformly fatal. Such a fatal peritonitis was found in the dog by ligating the appendix and mesoappendix thereby occluding the blood supply. When this was done the dog invariably died with a diffuse septic peritonitis in about 2 days, having run a uniform course of the disease. It was found impossible to set up a uniform peritonitis which would be of value for this experimentation by injecting bacteria into the peritoneal cavity. Human germs taken from an appendiceal abscess and dog germs taken from a dog with diffuse septic peritonitis were equally ineffectual in setting up a peritonitis when injected into the peritoneal cavity. The presence of the necrotic appendix was necessary in commencing the pathological process.

In the second stage of the experimentation the thoracic duct was ligated in the neck 24 hours after the appendix had been ligated and the abdomen closed. The first dog developed a thoracic duct fistula and promptly recovered. Four dogs recovered in a similar manner. In the third stage the duct was not only ligated but opened below the ligature so as to assure a drainage of lymph from the system. Three dogs recovered in this series.

It was shown that the damage done to the thoracic duct by the operation was overcome by the establishment of a collateral flow of lymph.

The experimentation demonstrated what it was intended to show, that there is a fatal

Fig. 1. First step.

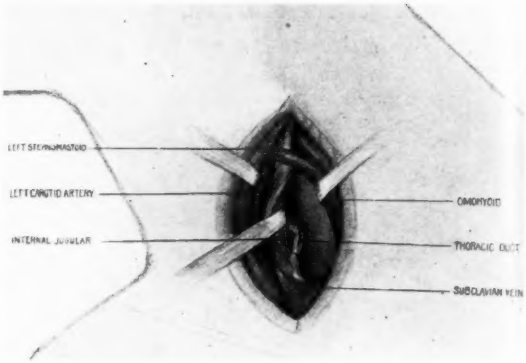


Fig. 3. Third step.

absorption through the thoracic duct. It not only proved the fact but it disproved a fatal absorption through the subperitoneal capillaries or through the diaphragmatic lymphatics to the anterior mediastinal lymphatics and the right lymphatic duct. It showed, moreover, what is perhaps the most extraordinary fact of all, that when a fatal absorption is overcome the peritoneal cavity is capable of looking after such a formidable structure as a necrotic appendix.

The experimentation was carried out between May, 1921, and the middle of 1922, and on October 10, 1922, I had an opportunity of applying the findings in a case of pneumococcic peritonitis in a girl of 9 years at the Sick Children's Hospital in Toronto.

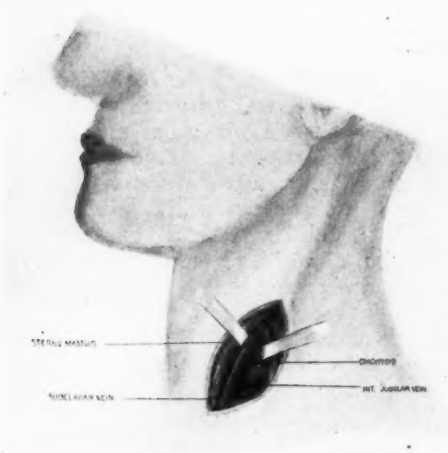


Fig. 2. Second step.

Miss G. B., age 9, admitted October 10. Patient was crying out with abdominal pain; she was toxic, the tongue was dry and coated; the abdomen markedly distended, rigid and uniformly tender to the lightest touch; dullness was present in flanks; temperature, 101°; pulse, 140; white blood cells, 13,000. Diagnosis: pneumococcic peritonitis.

Operation. Lymphaticostomy, midnight, October 10, 1922.

Under intratracheal ether a 3-inch incision was made along the lower posterior border of the left sternomastoid muscle. That muscle was freed by blunt dissection and drawn in exposing the omohyoid muscle which was drawn up. The internal jugular vein which was thus exposed was liberated down to the junction with the subclavian vein, rolled inward, and the thoracic duct about the size of a goose-quill brought into view. It was freed for about 1 inch and a ligature of plain catgut tied about it close to its entry into the vein. A half-inch longitudinal incision was made into the lumen of the duct a little distance below the ligature allowing the lymph to flow. Swabs were taken of this fluid for examination. A narrow strand of rubber was passed about half an inch down the duct. A single strand of half-inch, plain selvedged gauze was loosely tucked around the duct. The rubber strand, the gauze and one end of the ligature were brought to the surface and secured to the skin. The skin incision was then closed with a short quarter-inch soft rubber tube and a moist dressing was applied.

Blunt dissection made almost a bloodless operation so that it was not found necessary to ligate a vessel. Half a cubic centimeter of pus was aspirated from the right side of the peritoneal cavity for examination. The patient was exsanguinated and transfused, 600 cubic centimeters being drawn off and 800 cubic centimeters introduced. Patient made good recovery from operation.

Bacteriological findings: Culture from duct nega-

tive for pneumococcus; pus from peritoneal cavity contained pneumococcus IV; blood culture negative.

Unfortunately the duct fluid was not tested for toxicity. Rapid disappearance of all toxic symptoms, however, proved that absorption had ended.

Progress notes: October 11: Marked improvement. Abdomen softer and less painful. Tongue clean. Patient bright and asking for milk. Neck wound draining freely. Culture again negative for pneumococcus. Temperature, 101°; pulse, 120.

October 12: Condition excellent. Voluntary bowel movement. Lymph draining freely. Gauze removed. Given broth and lemon albumin. Temperature, 101°; pulse, 110.

October 13: Slight drainage from neck. Temperature, normal. Fluid diet.

October 16: Rubber tube removed. Sitting up in bed. Soft diet.

October 17: Strand of rubber removed. Practically no drainage from neck.

October 18: Stitches removed. Wound healing rapidly.

October 19: Slight evening rise of temperature. Some hardness in right iliac fossa which is not painful on pressure. No other symptoms.

October 23: The area of hardness extends up from Poupart's ligament about 3 inches, is a little painful on pressure; it has no definite boundary, is tympanitic and appears to be in the anterior abdominal wall. Patient looks well and is taking soft diet. Bowels move voluntarily. Temperature rises to 100° in the evening. White blood cells, 12,000.

October 24: The hardness in right side has disappeared. Temperature down.

October 30: Patient discharged cured.

The operation in peritonitis is not only unique but it is full of interest and opens up a wide field for discussion. What happens to the duct? In the surgery of the neck the ligation of the duct, when it has been opened by stab wounds or otherwise, is effectual in promoting recovery and in such cases a collateral flow of lymph occurs. The experimental work referred to and that reported by Frederick Lee (2) prove that a collateral flow is readily set up and that a ligation or an opening in the duct heals readily. Wilms (3) drained the duct for fat embolism in a man of 20 who fell from a second-story window. He divided the duct which drained freely for 36 hours. In the first 20 hours 2 quarts escaped. The vessel closed in 6 days and patient recovered. Murphy (4) quotes the statement by Jonnesco that systematic ligation of the duct has been resorted to several times in the human in some abdominal cancers. While the duct is draining there is a loss of the food constituents of the lymph and while this would entail a loss of weight in a normal individual when drainage is carried out, in a case of peritonitis this factor is negligible, for in such a condition there is little or no absorption of food until the abdominal symptoms have subsided and by that time the duct drainage has lessened and a collateral flow of lymph is being set up.

What happens to the pus remaining in the peritoneal cavity? In the dogs operated upon the pus disappeared without abdominal drainage and without apparent pocketing. In what way this was effected is a matter of conjecture. In the case reported it was thought for a few days that a localization of pus was occurring in the right iliac fossa, but this cleared up rapidly and no pocketing occurred. In the dogs, not only the pus but the necrotic appendix was disposed of, without operative interference.

It is not wise to judge the efficacy of lymphaticostomy on the result of this one case as it might be said that the patient may have recovered with peritoneal drainage, notwithstanding a mortality of about 90 per cent in children, and further recoveries must be reported before this procedure can be adopted by the profession to whom this case is presented in the light of a good hope for the future treatment of diffuse septic peritonitis.

To those who are accustomed to witness the postoperative course in abdominal drainage in peritonitis this case exhibited a happy contrast, for the postoperative treatment was attended by almost an absence of suffering.

This case demonstrated the following observations which featured in the experiments:

1. The elimination of toxic or bacterial absorption from the peritoneal cavity and the lumen of the bowel cuts short those symptoms which are commonly observed in postoperative peritonitis.

2. The wonderful ability of the peritoneal cavity to deal with an inflammatory process when not hampered by absorption.

3. Lymphaticostomy in itself is not a dangerous procedure.

REFERENCES

1. COSTAIN. Canadian M. Ass. J., 1922, Nov.
2. LEE. Bull. Johns Hopkins Hosp., 1922, Jan.
3. WILMS. Semaine méd., 1910, Mar. 23.
4. MURPHY. General Surgery, 1911, ii, 272.

OBSTRUCTION AT THE URETEROVESICAL VALVE

By THOMAS N. HEPBURN, M.D., F.A.C.S., Hartford, Connecticut

IT has been often observed that obstruction of a spastic nature at the bladder outlet may cause retention of the urine with marked distention of the bladder. I wish now to call attention to obstruction of the ureter due to a spastic condition of either the circulatory muscle fibers of the ureteral mouth or of the bladder muscle fibers surrounding the ureter in the intramural portion, causing distention of the ureter and kidney.

Every cystoscopist has noted that at times the ureteral os can contract to a pale dimpled knob, in which it is impossible to engage a catheter. Again he has noted that his catheter may be easily admitted into the ureter only to be clamped in the intramural portion by a spasm of the bladder. At times one ureter may be catheterized before the bladder goes into a spasm, which makes catheterization of the second ureter impossible, and we attempt to do a differential function with a catheter in the bladder to get the functional output from the non-catheterized side. To our surprise we find there is no output of any urine from this side. If pain develops in the non-catheterized side, similar to that for which the patient seeks relief, we may be tempted to make a diagnosis of serious renal pathology requiring nephrectomy. The true situation may be that the kidney is not at all diseased, but is functioning into a ureter that is closed temporarily by a spasm at its outlet. This spasm produces distention of the ureter and renal pelvis and this reproduces the original pain.

Not infrequently a patient gives a history of typical ureteral colic, first on one side and then on the other, or on both sides at the same time. The X-ray is negative for stone. In a quiescent period, bilateral catheterization may be accomplished and normal urine and normal function found from both kidneys. A diagnosis of small stone may be made, which the patient is sent home to pass. He gets well or has subsequent attacks. In the first instance we congratulate ourselves on our diagnostic acumen. If the second occurs, we examine him again with the same findings, and perhaps call him a small stone maker.

Occasionally we find a patient with a stone in one side and his pain in the other. Such a case may be reported as another example of "reno-renal reflex" or "crossed" sympathetic pain, while, as a matter of fact, the stone may not be causing obstruction to the urinary flow

Fig. 1. Case 1. Roentgenogram showing large ureter.

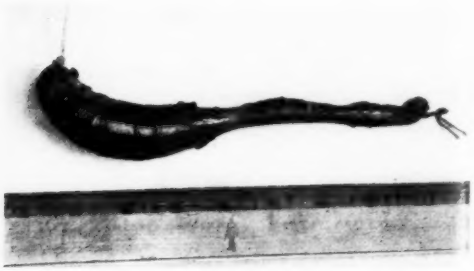


Fig. 2. Photograph of ureter removed in Case 1.

Fig. 3. Case 2. Roentgenogram showing remarkable shadow in left pelvis.

on its side, but may set up a spasm of the bladder that does obstruct the emptying of the opposite ureter, causing renal distention and colic.

Before the days of pyelographs and shadowgraph catheters, every surgeon has had the embarrassing experience of operating for shadows in the region of the lower end of the ureter and a typical history of renal colic, without finding a stone. In his effort to locate it he has opened the bladder and passed instruments up the ureter. The patient has gotten entirely well, but no satisfactory explanation has been given.

In support of my conviction that spastic obstruction at the ureteral outlet is a common and serious urological condition, I wish to present the following cases.

CASE 1. Mr. O'Meara, age 19, discharged from the Navy with complete disability from chronic pyelitis and cystitis. He had been in various Navy hospitals and had had various men attempt to catheterize his ureters without success. After many months of failure he was sent home completely disabled. He entered the Hartford Hospital and was referred to me. At cystoscopy I failed to catheterize either ureter because of spasm. In order to make a diagnosis I opened his bladder suprapubically, dilated the ureteral openings with sounds, and then catheterized both sides. I found the right kidney urine normal and the right kidney function as determined by phthalein to be normal. The left kidney urine

Fig. 4. Case 3. Roentgenogram showing multiple bilateral renal stone, dilated ureters, kidney pelvis and calices.

was full of pus and its function slight. A thorium X-ray picture of the left side showed marked hydronephrosis. The boy was in bad shape, so I did a quick left nephrectomy, taking about 2 inches of the ureter. The boy convalesced slowly and went home without fever. He continued to have recurrent attacks of pain in the left ureteral region and recurrent pyuria. I again catheterized the left ureter and injected thorium. The X-ray picture is shown in Figure 1. The catheter has slipped out of the ureter, but the large ureter is easily seen. I then removed the ureter clear down to the bladder. It is shown in Figure 2. Note the small opening into which a tooth pick is inserted with a very snug fit. Since then the patient has been entirely well.

CASE 2. Mrs. Brown, age 26, was seen by me at the Manchester General Hospital. She had been running a septic fever for weeks. Her X-ray (Fig. 3) revealed a remarkable shadow in the left side of the pelvis. Cystoscopy revealed a ribbon of pus coming from the left ureter, which could not be catheterized, and the right kidney was functioning normally. A mass could be felt in the left pelvis by vaginal examination. My diagnosis was pelvic ectopic pus kidney with stone. At operation I found an enor-

Fig. 5. Case 4. Roentgenogram showing remarkable looping of catheter in right ureter.

Fig. 6. Case 4. Roentgenogram showing distention of both ureters and renal pelves.

Fig. 7. Case 4. Roentgenogram taken with No. 26 F. rectal tubes up each ureter.

mously dilated ureter flopping down behind the bladder, with the point of the stone directed to the entrance of the ureter into the bladder wall. I resected the ureter at the bladder wall and dissected it up over the big iliac vessels with much difficulty and sutured it to the skin of the loin for nephrectomy at a later date, because the patient's condition did not appear to justify a continuation of the dissection at that time. I could not get any pictures of this ureter, but it was as big as an ordinary intestine, and the primary lesion appeared to be a spastic obstruction at the bladder. This woman's bladder was trabeculated. No Wassermann has yet been taken. Her pus kidney seemed to discharge itself through the ureter as she is now in good general health and very wisely refuses to let me complete my operation.

Case 3. Mrs. Cooper, age 35, entered the Hartford Hospital with right-sided renal pain, fever, pyuria. Her condition was bad. She had had back pain for years and had been getting progressively weaker. Bilateral ureteral catheterization showed pus from the right kidney and only a trace of phthalein from either in 1 hour after an intravenous injection. X-ray showed multiple bilateral renal stones and thorium injections showed dilated ureters and kidney pelvis and calices (Fig. 4). This distention appeared secondary to a spasm at the ureteral outlet, as she had a markedly trabeculated bladder. She died without surgical interference in 8 days. (Wassermann was negative.) Autopsy showed no obstruction to the ureters except at the intramural portion.

Case 4. Mr. Olson, age 37, was referred to my service at the Hartford Hospital by Dr. Hutchison. He had been treated for some time for chronic nephritis, having had several periods of œdema due to renal insufficiency. He had had no bladder symptoms. His renal function with the phthalein was only a trace. Finally he got a little fever and his urine showed a few pus cells, and he was referred for cystoscopy.

His bladder wall was perfectly normal, as were also his ureteral openings. My associate, Dr. Spillane, succeeded in catheterizing both ureters and found no leucocytes and only 15 per cent phthalein from right kidney and a trace from the left, with leucocytes. X-ray with the catheters showed the remarkable looping of the catheter in the right ureter (Fig. 5). Then for the first time we suspected a dilated ureter and injected thorium, showing the distention of both ureters and renal pelves, as seen in Figure 6.

Feeling that this man's nephritis was due to chronic back pressure from the spastic ureteral outlets, I decided to relieve this obstruction by operative procedure. Through a suprapubic incision I opened the bladder, dilated the ureteral openings with sounds, cut the ureter open from its os well up into the bladder wall, inserted a No. 26 F. rectal tube into each ureter and sutured them to the abdominal wall so that they could not slip out. The X-ray of this man with the No. 26 F. rectal tubes up each ureter is in Figure 7.

These tubes were left in for 10 days—the kidneys

Fig. 8. Case 4. Roentgenogram taken after wound had healed showing renal pelves and ureters all a portion of the bladder.

Fig. 9. Roentgenogram, Case 4, just after patient had voluntarily voided. Kidney pelves and upper ureter are empty.

being irrigated daily. His renal function rapidly improved. After 3 weeks' time, when the wound had healed, his bladder was filled with thorium to see if the ureterovesical valves were still destroyed. The picture is shown in Figure 8. It shows the ureters and renal pelves to be now all a portion of the bladder. The question was whether we may not have substituted the vesical sphincter for the spastic ureteral outlet as a cause of chronic back pressure on the kidneys. The next picture (Fig. 9) is taken just after the patient has voluntarily voided. It shows that the kidney pelves and upper ureters are empty. Therefore, if this man empties his bladder at reasonable intervals, his renal parenchyma will only be pressed upon for short periods. He was sent home with this advice and in 6 weeks has gained 20 pounds and a return of phthalein output to over 30 per cent.

Case 5. Mr. Kane, age 23, entered the Hartford Hospital on the service of my associate, Dr. Spillane, with acute right-sided renal colic and a history of having passed no water for 12 hours. There was no urine in his bladder. At cystoscopy we could not catheterize his right ureter because of spasm. He had a marked hypertrophy of the interureteric ridge. X-ray revealed a completely calcified tuberculosis of the left kidney. Rest, hot packs, and morphine finally relieved the spasm obstructing the right ureter and revealed a perfectly functioning right kidney. After a week's rest, we easily removed the left kidney, which is shown in Figure 10, as a completely calcified tuberculous kidney of the fœtal type. The patient made an uneventful recovery and was sent home in good condition. One month later he returned with complete suppression of urine again and looked quite toxic. Immediate cystoscopy under local anæsthesia permitted us to insert a catheter 25 centimeters in the right ureter and to draw off 400 cubic centimeters of urine in an hour. The catheter was left in and the patient was relieved of all pain. The catheter was withdrawn in 12 hours and thereafter he passed his urine normally for a week, while resting in bed. We then cystoscoped him and we were able to introduce 40 cubic centimeters of 15 per cent thorium which showed in the X-ray as in Figure 11. The operating cystoscope was then introduced and with flexible scissors the hypertrophied band of muscle overlying the intramural portion of the ureter was cut. The catheter was still in position and care was taken to keep from cutting through the mucosa of the ureter. The operation was similar to that devised by Rammstedt for pylorospasm in infants. The patient has so far had no further attacks.

ETIOLOGY

I do not feel sure of the etiology of this condition. There may be several factors at work. In some cases I suspect a congenitally

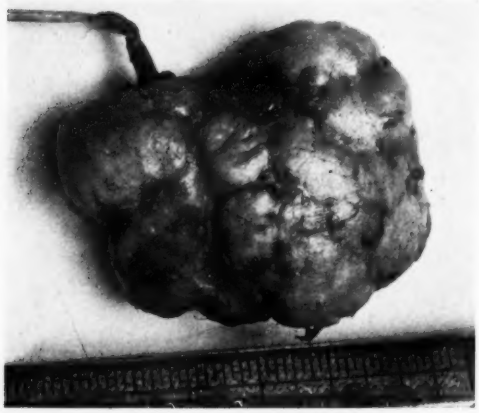


Fig. 10. Photograph of left kidney removed from Case 5.

strictured opening which may be completely closed at times by the ordinary muscle surrounding it. In some cases where the bladder muscle shows trabeculation, cordal lesion due to syphilis or other cause may be the etiological factor. The major group of cases comes, in my opinion, under the heading of spasm due to fatigue and nervous exhaustion. This group should be compared with spasm as seen in other organs—such as the lower end of the œsophagus, the pylorus, ileocæcal valve, the anus, or even the lumbar spasm of lumbago. All of these conditions are noted when the victim becomes run down or nervously exhausted. The attack may be precipitated by the passage of irritating urine, infection, small stones, or crystals.

TREATMENT

During the acute pain, morphia and heat are necessary as in any renal colic. Then complete rest in bed until relaxation is reestablished. Fluids should be forced to keep the urine non-irritating. Should the spasm continue long enough to cause pyelitis, immediate suprapubic incision into the bladder should be done and both ureteral openingt widely dilated with sounds. (Of course this applies only when the ureters cannot be dilated through a cystoscope.) Should the X-ray pictures with a shadow-making fluid show the ureters to be widely dilated and marked pyelitis and parenchymal deficiency

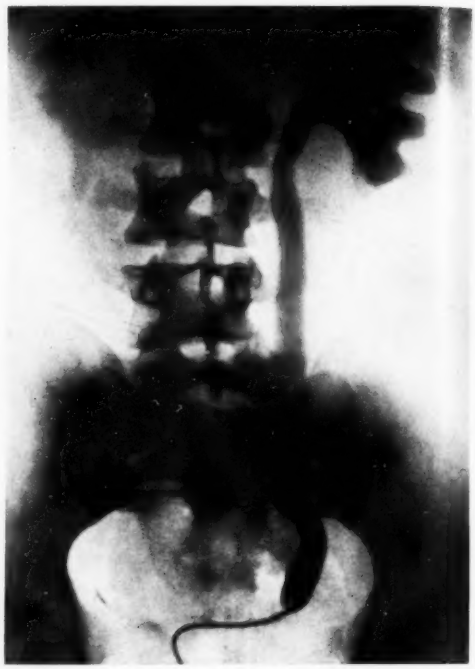


Fig. 11. Case 5. Roentgenogram of right ureter and kidney after introduction of 40 cubic centimeters of 15 per cent thorium.

exist as in Cases 1 and 4, I believe a complete destruction of the ureterovesical valve should be done. Should the ureter show only moderate chronic distention and the urine be free from pus and the kidney show good function, I believe the operation should be to cut the muscles down to the mucosa—thus leaving the valve intact, as in the Rammstedt operation for pylorospasm.

PROGNOSIS

Should the obstruction continue, hydroureter hydronephrosis, infection, stone formation and destruction of renal parenchyma follow. The results of the operative procedures which I suggest are problematical, as my work has been too recent to draw positive conclusions.

I wish to express my gratitude to my associate, Dr. Bernard Spillane, for his very helpful co-operation in this work.

A CONTRIBUTION TO THE STUDY OF THE EFFECTS OF RADIUM UPON RABBIT OVARIES[1]

By HOWARD A. WEIS, M.D., Davenport, Iowa
From the Department of Obstetrics and Gynecology, College of Medicine of the State University of Iowa

THIS work was attempted with the idea of demonstrating the effects of a given standard dosage of radium upon rabbit ovaries.

A review of the current medical literature revealed only one article devoted exclusively to this subject, that of Dr. John M. Maury,[2] in which he concludes that neither the large nor the small graafian follicles of rabbit ovaries were influenced by a radium dosage of 600 milligram hours. This conclusion being quite the opposite of the generally accepted belief, we undertook our series of experiments with the idea of perhaps throwing further light on this particular subject.

In performing these experiments we have kept as many factors constant as possible. The dosage of radium used was always 600 milligram hours, that dosage being selected because it is conceded by most authorities that 600 milligram hours of radium applied intra-uterinely will be usually sufficient to produce an amenorrhœa for several months, and sometimes permanently; the generally accepted theory being that this result is due to the fact that the radium-rays destroy all the maturing follicles most advanced in development, and the return of menstruation occurring because the more immature follicles had not been destroyed. When these matured, menstruation resulted. But this explanation is contrary to the biological law which states that the less mature the cell, the greater its susceptibility to disintegrating influences.

For most of the exposures we used 50 milligrams of radium in the form of radium barium sulphate in two 25 milligram tubes, but in a few cases we used 100 milligrams, using in addition four 12½ milligram needles of radium barium sulphate. The radium was filtered with a glass, a silver, and a brass screen, and this inserted in a rubber tube of 1 millimeter thickness to filter out the so-called secondary γ-rays. This method of screening gave us practically only the γ-rays to work with, this, however, being in keeping with most of the radium therapy of the present day. The tubes were then fastened to a lead frame by adhesive, and this fastened by means of adhesive and a wide gauze bandage, as nearly over the rabbit's ovary as we could determine. The wide bandage was used to hold the radium securely in place when the rabbit assumed a squatting posture, and prevent the thighs interposing between the radium and the ovary to be treated. This bandage was applied quite snugly and with the animal well stretched out.

If 50 milligrams were being used it was left in place for 12 hours; if 100 milligrams, for 6 hours; and during these intervals frequent examinations were made to be sure that it had not become displaced.

We endeavored as far as possible to duplicate each experiment. In each of nine rabbits the right ovary was removed, and then at a later date, from 4 to 10 days, the other ovary was exposed to radium. This rayed ovary would then be removed at a certain fixed time, and the sections of the two ovaries compared, the ovary removed first acting as a control. In seven other rabbits the right ovary in each was rayed and then both ovaries removed later at a fixed time for each animal. Sections of the two ovaries were then compared. Finally, both ovaries were exposed to radium in two rabbits and these bred after an interval of 6 weeks to see if they would produce a litter.

When the ovaries were removed they were placed at once in a 10 per cent solution of formalin and kept there from 18 to 24 hours, after which they were put through a series of alcohols to dehydrate and harden them. They were then placed in the paraffin bath,

[2] Maury, John M. The result of exposure of animal ovaries to rays of radium. J. Am. Med. Ass., 1920 lxxiv, 1711.

[1] Submitted in partial fulfilment of the requirements for the degree of Master of Science of the Graduate College of the State University of Iowa, 1922.

blocked, and sectioned. Sections were made from the center and both ends of each ovary, and as many as 75 to 350 sections made from each. They were stained by the alum-hæmatoxylin and eosin method. The sections were studied with special reference to—

1. The condition of the germinal epithelium.
2. The condition of the ovarian follicles.
3. The condition of the blood vessels as regards the presence of any obliterative endarteritis.
4. The condition of the interstitial cells.

The ovary of a rabbit differs considerably from a human ovary. Around the periphery is a single layer of germinal epithelial cells. Beneath this is a rather dense, connective-tissue cortex in which are located the ova in the various early stages of development, and as the follicles increase in size they encroach upon the interior of the ovary. The remainder of the ovary is composed of large, epithelial cells in a usually scanty connective-tissue frame-work, through which the blood supply is carried. The amount of fibrous connective tissue in rabbit ovaries varies considerably.

The ovaries in a rabbit are quite uniformly placed in either flank, and suspended from the dorsal wall by a short mesovarium. They lie a short distance above the crest of the ileum, and a short distance below the kidney. There is quite a variation in their size, but does that have had numerous litters have the largest ovaries. One ovary is often larger than the other. Except perhaps the cæcum, which may and may not intervene, there is very little tissue lying between the radium and the ovary to be treated, so that the radium-rays could reach the ovary much easier than they could when placed intra-uterinely in the human. I do not think that the radium was over one and a quarter inches distant from the ovary in any of these cases, and I would place the average at a much smaller distance than that.

It was necessary to study a great many sections from presumably normal rabbit ovaries in order to learn the histology that might be found. As in other animals, a great many graafian follicles in the rabbit ovaries never reach complete development, this being especially true in the rabbit because in these animals ovulation occurs only with copulation. So that there are always a number of follicles undergoing normal atresia. In rabbits, ovulation occurs from 9 to 10 hours after copulation, and the graafian follicles will not rupture and discharge the ovum unless copulation has taken place. This made it necessary to distinguish between normal atresia and the degeneration of the follicle that might be caused by radium action, provided that the latter had such an effect. The following paragraphs taken from an article by Walter Heape, entitled "Ovulation and Degeneration of Ova in the Rabbit,"[1] describe the normal degeneration of the follicle.

"The follicle is distended and projects on the surface of the ovary, its outer wall is thin, and the whole structure is very vascular, precisely as is the case with the follicles that do rupture after copulation; but it does not rupture, instead, the surrounding congested vessels rupture and pour their blood into the follicle itself, forming there a clot of blood, in the midst of which the degenerating ovum may be seen for several days. This result causes the brilliant, suffused red color of degenerate ripe follicles at an early stage of the process; gradually the red color is lost and results in a black patch which long persists and which is reduced as time goes on by the absorption of the contents of the follicle.

"The first rush of blood isolates the ovum and its discus proligerus, and subsequently washes away the rest of the epithelium from the walls of the follicle, disintegrates the theca interna, and permeates the meshes of the theca externa."

The intervals taken between the time at which the ovary was exposed to the radium and the time when it was removed for sectioning varied from 9 days to 10 weeks; 4, 6, 8, and 10 week intervals being used for the most part, as the period of maximum activity of the radium-rays is said to be between 6 and 8 weeks. Two rabbits died following their radium treatment from causes not attributable however to the radium, one 9

[1] W. Heape. Proc. Roy. Soc., Lond., Series B, 1905, lxxvi, 260.

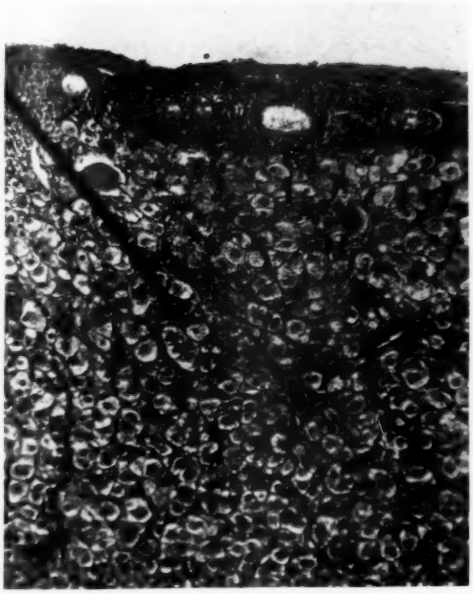


Fig. 1. Section of rayed ovary of Rabbit 1. The nature of the medullary portion of the ovary is well shown, and it is these large epitheliod cells that we have referred to as interstitial cells. In the cortex at about the center is a well-preserved primordial follicle.

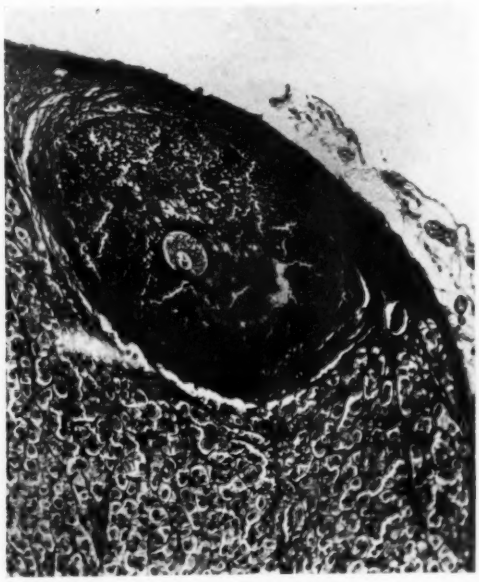


Fig. 2. Section showing a well-advanced graafian follicle with the ovum and its nucleus well shown. The section was made 6 weeks after radium was used.

days, and the other 11 days, following exposure.

In only one case did we find extensive adhesions produced intraperitoneally by the radium, rabbit No. 12 showing marked adhesions beneath the site of the radium between the abdominal wall and the cæcum. This rabbit also had marked hair loss and considerable inflammatory skin reaction, and was one of the rabbits upon which 100 milligrams of radium were used. Practically all of the rabbits showed hair loss, but the extent of the skin reaction varied. The rabbits seemed to show very little reaction to the radium treatments, and ate heartily and ran about the pens the same as usual. But we did find that they developed subcutaneous abcesses over the abdominal and pelvic regions, both the ones that were operated upon and the ones that were not. This is in keeping with the experience of other men who have exposed animals to radium, namely, that the animals practically always develop skin lesions following exposure.

Rabbit 1. Brown doe; weight 8 pounds. On December 13, 1921, 50 milligrams of radium were applied over the left ovary for 12 hours. After an interval of 6 weeks or on January 25, 1922, the rabbit was killed and both ovaries removed. Estimated distance of radium from the ovary 3¼ centimeters. Right ovary measured 25 millimeters long; 10 millimeters in widest diameter. Many follicles were visible on the surface.

The left ovary was 21 millimeters long; and 7 millimeters in widest diameter. Scarcely any follicles were visible on the surface. There was no evidence of any local inflammation around the ovary.

Both specimens were put into 10 per cent formalin solution at once.

Microscopic examination. Left ovary.

1. The sections of the rayed ovary are much the smaller.

2. There is a marked increase in the amount of connective-tissue cortex.

3. The single row of germinal epithelial cells around the periphery of the ovary shows no change as compared to the untreated ovary.

4. There are a few follicles present, but all of them are small and quite immature except 3 which are

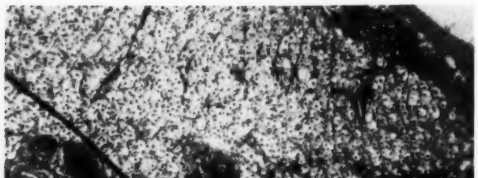


Fig. 3. Section demonstrating the large blood vessels that are found in the rabbit ovary. This section is from the rayed ovary of Rabbit 9. Certainly no obliterative endarteritis is seen in this section.

slightly farther advanced. The entire ovary was sectioned and not one follicle found in the cumulus stage.

5. There is no evidence of an obliterative endarteritis, the blood vessels appearing quite normal.

6. There was not a single corpus luteum in any stage found in the entire ovary. In only one other instance was this observed, and that in Rabbit 18 left, an untreated ovary.

7. There is more connective tissue in this ovary than is usually the case.

8. The large epithelial cells in the interstitial portion of the ovary show no apparent change. They are of normal size, with nuclei round and centrally placed, and show the usual amount of chromatin granules.

Right ovary.

The control ovary. The sections are those of an apparently normal ovary and show follicles in all stages of development, and several corpora lutea.

Rabbit 2. Gray doe; weight 7 pounds. On December 17, 50 milligrams of radium were applied over the right ovary for 12 hours. Both ovaries were removed after an interval of 8 weeks, on February 13. The right ovary looked perfectly normal and showed follicles visible on the surface. It was 14 millimeters long, and 2½ millimeters in greatest diameter.

The left ovary was much larger, measuring 15 millimeters long and 5 millimeters in diameter. About the same number of follicles could be seen on the surface as in the other ovary, the only apparent difference between the two being in size.

Microscopic examination. Right ovary.

1. Sections smaller in diameter than in the untreated ovary.

2. Some increase in the number of cellular elements in the connective-tissue cortex.

3. Germinal epithelium unaltered.

4. Sections from the ovary show some very good examples of maturing follicles. Some sections show as many as five well-advanced follicles with one or more in the cumulus stage, and with the ovum in a very good state of preservation.

5. No evidence of obliterative endarteritis.

6. Occasional corpus luteum seen.

7. No increase in the amount of fibrous connective tissue throughout the medullary portion of the ovary.

8. The interstitial cells show no change.

Left ovary.

Control. Normal ovary, with numerous follicles in various stages of development.

Rabbit 3. Small brown doe; weight 4 pounds. On January 9, 50 milligrams of radium were applied over right ovary for 12 hours. After an interval of 4 weeks, on February 6, both ovaries were removed. Microscopically, no difference could be seen in the two ovaries. Each measured 1 centimeter long, and 3 millimeters in diameter. There were 3 or 4 discolored spots on each, the site of atretic follicles.

Microscopic examination. Right ovary.

1. Both ovaries of equal size.

2. The connective-tissue cortex is wider and appears more dense than in the other ovary.

3. Germinal epithelium unaltered.

4. Half the ovary is occupied by a single follicle. In sectioning the ovary this follicle has been partially destroyed but two slides show the ovum and in good state of preservation. It has advanced to the cumulus stage of the follicle. Numerous other smaller follicles are seen.

5. No obliterative endarteritis.

6. No corpus luteum seen.

7. No increase in the amount of fibrous connective tissue in the medullary portion of the ovary.

8. No change in the epithelial cells of the medullary portion.

Left ovary.

Control. Contains many early follicles and one well advanced. No well-developed corpus luteum seen.

Rabbit 4. Brown doe; weight 6 pounds. The right ovary was removed January 9. It was 1 centimeter long.

On January 16, 50 milligrams of radium were applied over the left ovary for 12 hours. Eleven days later the rabbit had to be killed and the left ovary was removed. It was 1 centimeter long, and looked like a normal ovary.

Microscopic examination. Right ovary.

Control ovary. The sections are those of a normal ovary and reveal numerous graafian follicles in all stages of development.

Left ovary.

1. Ovaries equal in size.

2. The connective-tissue cortex is very narrow in this case.

3. No change in the germinal epithelium.

4. There are not as many ova and follicles in these sections as we usually see. However, some

sections show as many as 4 well-advanced graafian follicles, though they have been mostly destroyed in sectioning.

5. No evidence of obliterative endarteritis.
6. Normal corpora lutea present.
7. No change in the fibrous connective tissue, except the scanty cortex above mentioned.
8. No change in the medullary cells.

Rabbit 5. Tan doe; weight 8 pounds. On January 9, 50 milligrams of radium were applied over the right ovary for 12 hours. On January 16, 50 milligrams were applied over the left ovary for 12 hours. After an interval of 6 weeks, this doe was put in with a buck, and on March 30, produced a litter of 7 normal rabbits, all of which lived.

Rabbit 6. Large Fleming giant doe; weight 14 pounds. On January 11, the right ovary was removed. On January 17, 50 milligrams of radium were applied over the left ovary for 12 hours. Six weeks later, on February 28, this left ovary was removed. It was 12 millimeters long, and 4 millimeters in greatest diameter. Many follicles were visible on the surface.

Microscopic examination. Right ovary.

Control ovary. Sections normal, and show a great many graafian follicles, some of them with two distinct ova.

Left ovary.

1. Equal in size to the right.
2. The connective-tissue cortex was here not as dense as in some of the other rayed ovaries.
3. No change in the germinal epithelium.
4. There are numerous graafian follicles in different stages of development, some sections showing three that are almost ready to rupture. The ovum can be seen in all, well preserved.
5. No obliterative endarteritis.
6. As compared with the opposite ovary there is more fibrous connective tissue present in the medullary portion of the ovary.
7. No change in the interstitial cells.

Rabbit 7. Small brown doe; weight 7 pounds. On January 17, the right ovary was removed. On January 23, the left ovary was exposed to 50 milligrams of radium for 12 hours. Eight weeks later, or on March 20, this ovary was removed. It measured 12 millimeters long, and 6 millimeters in diameter. Microscopically it was normal, and seven well-advanced follicles could be seen on the surface.

Microscopic examination. Right ovary.

Control ovary. The sections are those of a normal ovary with the usual amount of follicle development.

Left ovary.

1. The ovary is almost twice as large as the control ovary.
2. The connective-tissue cortex is a trifle more dense.
3. No change in the germinal epithelium.
4. Well-advanced graafian follicles are not numerous. One large corpus hæmorrhagicum is present, and one smaller one. In some sections of the smaller one the corpus luteum can be seen beginning to form, the large pigmented granular cells being present. The large follicle has evidently just begun to degenerate. There are some primordial follicles in good state of preservation, and some farther advanced with ova visible.
5. No obliterative endarteritis.
6. Normal luteal bodies.
7. No marked increase of fibrous connective tissue in the medullary portion of the ovary.
8. No change in the interstitial cells.

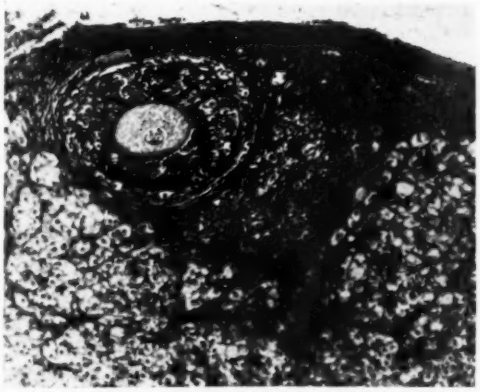


Fig. 4. Section made from the rayed ovary of Rabbit 8, 10 weeks after exposure. It shows a young graafian follicle with the ovum and its nucleus.

Rabbit 8. Small brown doe; weight 5½ pounds. The right ovary was removed January 18. On January 23, 50 milligrams of radium were placed over the left ovary for 12 hours. On April 3, or 10 weeks after exposure, this ovary was removed. It was 12 millimeters long, and 5 millimeters in the greatest diameter. The ovary and surrounding tissues were somewhat injected. On the surface of the ovary a dozen follicles were visible. The position of the radium had been less than an inch from the ovary. There did not appear to be any inflammation in the surrounding peritoneum.

Microscopic examination. Right ovary.

Control ovary. These sections show a great many ova, more than usually seen in the domestic rabbit. The follicles are in all stages of development.

Left ovary.

1. The ovaries are of equal size.
2. Some thickening of the connective-tissue cortex.
3. No change in the layer of germinal epithelium.
4. The treated ovary has far fewer follicles than the right, but such a difference is evidently common in rabbit ovaries. Follicles are found in all stages of development, and all apparently uninjured by the radium. There is one recent corpus hæmorrhagicum in which can be seen the beginning corpus luteum.

Other follicles are seen in the macula stage, one section showing the ovum intact, and with the nucleolus readily visible. There are several follicles not quite so far advanced as the cumulus stage, showing good ova and nuclei.

5. No obliterative endarteritis.
6. Many corpora lutea seen.
7. No increase in the fibrous connective tissue in the medullary portion of the ovary.
8. No apparent change in the interstitial cells.

Rabbit 9. Small brown doe; weight 4½ pounds. On January 18, 50 milligrams of radium were applied over the right ovary for 12 hours. Both ovaries were removed on March 29, 10 weeks after radiation. The right ovary was smaller than the left, and measured 13 millimeters long and 5 millimeters in diameter. It also contained fewer visible follicles than the left. The left ovary measured 12 millimeters long, and 6 millimeters in diameter. The radium had been placed within 2 centimeters of the right ovary.

Microscopic examination. Right ovary.

1. This is the smaller ovary.
2. The connective-tissue cortex appears a bit more cellular than in the left.
3. No change in the germinal epithelial cells.
4. There are follicles seen in all stages of development, but more primordial than well advanced. These younger ova show nuclei and nucleoli in good condition. A few graafian follicles have reached the cumulus stage with the ova and nuclei normal.
5. There is no obliterative endarteritis.
6. Corpora lutea present.
7. There is a slight increase in the amount of fibrous connective tissue in the medullary portion of the ovary.
8. No change in the interstitial cells.

Left ovary.

Control ovary. Sections from this ovary show more ova present in the several stages of development, and some sections show 4 or 5 well-advanced graafian follicles.

Rabbit 10. Brown doe; weight 7½ pounds. Right ovary removed January 30. The pelvic organs were very much injected, and even the small blood vessels bled considerably. On the surface of the ovary are 4 bright red spots, presumably follicles just recently ruptured. The ovary measured 15 millimeters long, and 6 millimeters in diameter.

On February 14, 50 milligrams of radium were applied over the left ovary for 12 hours. This ovary was removed 4 weeks later on March 14. It measured 19 millimeters long, and 8 millimeters in diameter. There were 7 large follicles visible on the surface. It was certainly a normal-looking ovary.

Microscopic examination. Right ovary.

Control ovary. Many graafian follicles present in advanced stages of development. Normal ovary.

Left ovary.

1. Considerably larger than the right.
2. No change in the connective-tissue cortex.
3. No change in the germinal epithelium.
4. It was necessary in this case to section almost two-thirds of the ovary before we could find any graafian follicles in the cumulus stage. A few less matured ova were seen and with nuclei and nucleoli in good condition. All sections, however, were conspicuous for their lack of ova. There were 3 corpora hæmorrhagica of recent origin, their cavities filled with blood.
5. No obliterative endarteritis.
6. Corpora lutea seen in various stages, but very few.
7. Some slight increase in the amount of fibrous connective tissue in the medullary portion of the ovary as compared to the right ovary.
8. No change in the interstitial cells.

Rabbit 11. Small white doe; weight 4 pounds. On February 6, 50 milligrams of radium were applied over the right ovary for 7 hours, and on February 7, for 5 hours more.

On February 10, 50 milligrams were placed over the left ovary for 12 hours.

After an interval of 6 weeks this rabbit was bred to see if she would produce a litter. She was placed with a buck later on also but when killed on May 18, no pregnant condition was found. The ovaries were both very small. The right measured 9 millimeters long, and 1½ millimeters in widest diameter. The left was 8 millimeters long and of the same diameter.

Microscopic examination. Right ovary.—Left ovary.

These two ovaries presented a most unusual picture. The connective-tissue cortex was extremely wide and cellular, constituting practically half of the ovary. There were no ova seen in either ovary, and, of course, no graafian follicles. In the right ovary, however, was a newly forming corpus luteum, and some other sections showed another very much older; it was almost a corpus albicans except for some pigmented cells in the center. The germinal epithelium was normal, and the blood vessels showed no change, and the medullary cells were also normal.

Rabbit 12. White doe; weight 6 pounds. On February 28, 75 milligrams of radium were placed over the right ovary for 8 hours.

On May 9, 10 weeks later, both ovaries were removed. There were many adhesions between the abdominal wall and the cæcum beneath the site of radiation. There was also a very marked skin reaction in this case. The left ovary measured 12 millimeters long, and 6 millimeters in diameter. There were 4 follicles visible on the surface.

The right ovary was 18 millimeters long, and 6 millimeters in diameter and showed a great many follicles visible on the surface, many of them hæmorrhagic.

Microscopic examination. Right ovary.

1. Larger than the control.
2. Connective-tissue cortex similar to the left.
3. No change in the germinal epithelium.
4. Through the middle portion of the ovary there were no advanced follicles and only a very few ova

of any description, but at either end there are 3 or 4 large follicles in most every section.

5. No obliterative endarteritis.

6. Through the center of the ovary are three normal corpora albicans.

7. No increase in fibrous connective tissue.

8. No change in the interstitial cells.

Left ovary.

Control. Not many follicles present. Some sections show a corpus hæmorrhagicum recently ruptured, and a graafian follicle approaching the cumulus stage.

Rabbit 13. White doe; weight 8 pounds. Had a litter of seven about 6 weeks ago.

On April 26, 100 milligrams of radium placed over the right ovary for 6 hours. Eight days later this doe gave birth to a litter of ten apparently full-term rabbits. The following day she died of "snuffles" and both ovaries were then removed. This was on the ninth day after exposure.

The right ovary was 22 millimeters long, and 7 millimeters in diameter.

The left ovary was 19 millimeters long, and 7 millimeters in diameter. Both ovaries were normal in appearance and consistency. There was no hair loss as yet.

Microscopic examination. Right ovary.

1. Treated ovary larger in this case.

2. The connective-tissue cortex is the same in each ovary.

3. No change in the germinal epithelium.

4. Four well-advanced follicles observed, the nucleus intact in each. In two of these follicles some hæmorrhage had occurred.

5. No obliterative endarteritis.

6. Normal corpora lutea.

7. No difference in the amount of fibrous connective tissue in the medullary portion of the two ovaries.

8. No change in the interstitial cells.

Left ovary.

Control ovary. Contains one very large corpus luteum which occupies about four-fifths of the diameter of the ovary at that portion. There are 3 large graafian follicles, two of which are evidently atretic, but the third is well advanced in the cumulus stage. Another smaller one was seen, not quite so far advanced but with the ovum and its nucleus evidently unchanged.

Rabbit 14. Small dark gray doe; weight 4 pounds. Right ovary removed February 1. It measured 12 millimeters long and 2½ millimeters in diameter, and though the diameter was relatively small it was otherwise a normal appearing ovary.

On February 14, 50 milligrams of radium were applied over the left ovary for 12 hours. Ten weeks after exposure, on April 25, the left ovary was removed. It measured 12 millimeters long, and 5 millimeters in diameter. Though a small ovary, there were 8 or 10 follicles visible on the surface. Estimated distance of the radium from the ovary 2½ centimeters.

Fig. 5. Section taken from rayed ovary of Rabbit 4, 11 days after exposure to 600 milligram hours of radium. The single layer of germinal epithelium is seen at the periphery. Beneath it is the connective-tissue cortex containing the primary ovary. There are 4 graafian follicles shown here, two of them in the cumulus stage and one almost completely matured. In the two largest follicles the ova are shown. The nature of the medullary epithelium is also well demonstrated.

Microscopic examination. Right ovary.

Control ovary. Apparently normal ovary with several well-advanced graafian follicles.

Left ovary.

1. Larger in diameter than the right.

2. The connective-tissue cortex is wider than in the right ovary and stands out more prominently.

3. No change in the germinal epithelium.

4. The sections show well advanced graafian follicles, some of them with the ovum present and in good condition. In the discus proligerus and surrounding zone we find evidence of rather active mitosis, showing the follicle to be in active growth. Many other less far advanced follicles are seen, ova intact and showing nuclei and nucleoli.

5. No obliterative endarteritis.

6. Normal corpus luteum seen.

7. No evident increase in the amount of connective tissue in the medullary portion.

8. No change in the medullary epithelium.

Rabbit 15. Dark gray doe; weight 7 pounds.

Right ovary removed January 31. Was a normal appearing ovary of the average size, measuring 14 millimeters long, and 4 millimeters in diameter. A number of follicles were seen on the surface.

On February 8, 50 milligrams of radium were applied over the left ovary for 12 hours. This ovary was removed after an interval of 6 weeks, or on March 22. It measured 17 millimeters in length, 8 millimeters in diameter, and was a normal appearing ovary with several follicles visible on the surface.

Microscopic examination. Right ovary.

Control ovary. This ovary does not show very many graafian follicles, but there are a few well advanced in the cumulus stage, and some others not so far along.

Left ovary.

1. The rayed ovary was slightly larger.
2. The connective-tissue cortex is very narrow and not as wide as in the opposite ovary.
3. The germinal epithelium shows no change.
4. Well-advanced graafian follicles in the cumulus stage were not seen. Two corpora hæmorrhagica were found placed close together and filled with blood. Another shows the corpus luteum just beginning to form, with the cells at the periphery of the blood clot filled with yellow pigment, some fibrin being laid down, and early blood vessel formation. Two ova were found in the late primordial stage in a good state of preservation.
5. There is no obliterative endarteritis, and on the contrary this ovary has a very rich blood supply with vessels of large caliber.
6. Corpora lutea present.
7. No change in the amount of fibrous connective tissue in the medullary portion of the ovary.
8. No change in the interstitial cells.

Rabbit 16. Grayish brown doe; weight 9 pounds. Right ovary removed February 15.

On March 1, 100 milligrams of radium were placed over the left ovary for 6 hours. After an interval of 8 weeks, or on April 25, this ovary was removed. It measured 20 millimeters long, and 8 millimeters in diameter. It appeared normal, and 12 to 15 follicles were visible on the surface.

Microscopic examination. Right ovary.

Control ovary. A normal ovary, some sections showing as many as 7 or 8 well-advanced graafian follicles.

Left ovary.

1. This rayed ovary is about 2 millimeters larger in diameter.
2. No difference in the connective-tissue cortex.
3. Germinal epithelium unchanged.
4. Normal well-developed graafian follicles seen, as many as six in a single section, all of them either in the cumulus stage or approaching it. The nuclei are well preserved in these ova, and some show two nucleoli in good condition. There are many primordial ova and one corpus hæmorrhagicum that has just recently been formed and is filled with blood.
5. No obliterative endarteritis.
6. No change in the amount of connective tissue present in the ovary.
7. Normal corpus luteum seen.
8. No change in the interstitial cells.

Rabbit 18. Small dark gray doe; weight 3 pounds. This doe is about 6 months old. On March 13, 100 milligrams of radium were placed over the right ovary for 6 hours. Both ovaries were removed after an interval of 4 weeks, or on April 25.

The right ovary measured 16 millimeters long, and 6 millimeters in diameter, and there were 3 follicles visible on the surface. The left ovary was 14 millimeters long, and 5 millimeters in diameter. It was whiter than a normal appearing ovary and looked rather sclerotic, and not a single follicle was visible on the surface. This was the only ovary examined (except the ovaries in Rabbit 11) where such was the case.

Microscopic examination. Right ovary.

1. The rayed ovary was larger than the control.
2. No change in the connective-tissue cortex.
3. No change in the germinal epithelium.
4. The rayed ovary shows 4 large corpora lutea, evidently perfectly developed. There was one large graafian follicle seen, but it had been partially destroyed by sectioning, as was usually the case with the atretic follicles such as this was. There were a few primordial ova in good condition.
5. No obliterative endarteritis.
6. Normal corpora lutea, as above stated.
7. No change in the medullary portion of the ovary and medullary epithelium.

Left ovary.

Control ovary. Shows no well-advanced follicles at all. There are several in the primordial stage and in good condition. This control ovary and the rayed ovary in Rabbit 1 are very much alike; and one was rayed and the other was not.

Rabbit 20. Large gray doe; weight 11 pounds.

Right ovary removed March 14. It was a large ovary and measured 19 millimeters in length, and 8 millimeters in diameter.

Fifty milligrams of radium were applied over the left ovary for 7 hours on March 21; and on March 24, 100 milligrams for 2½ hours, this making a total of 600 milligram hours. This ovary was removed after an interval of 4 weeks, on April 18. It measured 19 millimeters long, and 10 millimeters in diameter. It was a normal appearing ovary with numerous follicles visible on the surface.

The estimated distance from the radium to the ovary was not over 24 millimeters.

Microscopic examination. Right ovary.

Control ovary. No completely matured graafian follicles in these sections, but there are a few approaching the cumulus stage, and there are several primordial ova.

Left ovary.

1. The length of both ovaries was the same but the rayed ovary was larger in diameter.
2. The connective-tissue cortex of the rayed ovary is wider and more cellular.

3. Germinal epithelium unchanged.

4. Many sections show as many as 5 graafian follicles well advanced in the cumulus stage and almost mature. Some sections were cut through an ovum which is shown in good condition. The primordial ova are also unharmed.

5. No obliterative endarteritis.

6. Normal corpus luteum.

7. The medullary portion of the ovary shows the normal amount of fibrous connective tissue.

8. No change in the interstitial cells.

Finally, one guinea pig was rayed with 350 milligram hours over the right ovary. Six weeks later the pig was killed in order to remove both ovaries. Upon opening the abdomen we found the left uterus pregnant with a fœtal pig practically at term. In the right uterus we found a small amount of pus, and a small placenta that measured 10 millimeters in diameter, but no fœtus.

The radium had been applied very shortly after the pig became pregnant and evidently a missed abortion had taken place in the right uterus, probably due to the action of the radium on the endometrium, or perhaps on the true corpus luteum.

Sections of these pig ovaries showed evidently normal ovaries, each containing a great many well-matured graafian follicles, and large corpus luteum. There had been no cessation on the part of the maturing ova in spite of the pregnancy.

SUMMARY

1. In none of the ovaries could we see any change in the single row of germinal epithelium after exposure to radium.

2. We saw no evidence of any obliterative endarteritis in the rayed ovaries, and the blood vessels in the ovary are for the most part quite large and any change occurring in them should be readily noticed.

3. Very little information can be gained by comparing the sizes of the rayed and control ovaries. In five rabbits the ovaries were of equal size; in three the rayed ovaries were the larger.

4. Six ovaries showed little or no change evident in the connective-tissue cortex; but ten others showed an increase in the number of cells in this area, and four showed a definite widening of this zone.

5. As to the effects of the radium upon the ova and maturing graafian follicles we have no evidence in these sections to prove that they have been affected. Certain it is, that the young and early maturing ova have not been harmed. And while we have no evidence here to show that the radium actually destroys matured follicles, it is in these follicles that the most active cell division is taking place, especially in the region of the discus proligerus, and such being the case, one might easily imagine these many newly formed cells being more susceptible to radiation. But the sections of these ovaries were not made, in the earliest case, until 9 days after the radium exposure, and though these particular sections contained well-advanced graafian follicles, still we have no evidence conclusive that others equally matured were not destroyed 36 to 48 hours after the animal was exposed to radium.

In Rabbit 1 the control ovary was quite normal, while the rayed ovary showed no maturing follicles and no corpus luteum in any stage. Without a good knowledge of the normal ovary one might easily have assumed that the radium was responsible for the lack of follicles.

In Rabbit 18 the two ovaries show practically the same histological pictures except that the control ovary contained no corpus luteum in any stage. Neither ovary contained a well-advanced graafian follicle.

Rabbit 15, though showing a scarcity of ova in both ovaries, showed three large recently ruptured corpora hæmorrhagica in the rayed ovary, which had not been removed until 6 weeks after radiation. The control ovary had been removed before any radium had been put on the rabbit, but it failed to show as much activity in the follicles as the rayed ovary; so that the scarcity of follicles in the latter can scarcely be attributed to the radium rays.

The ovaries of Rabbit 11 contained no follicles or ova and for the exception of a corpus luteum and a corpus albicans there is no evidence to show that these ovaries ever have been active. The rabbit is young but that alone would not explain the condition. But there is no evidence of any necrosis or inflammation, the blood vessels are normal, and neither the medullary epithelium nor the germinal epithelium show any change. The amount of fibrous connective tissue in these two ovaries was out of all proportion to the amount usually seen, and one could very well call these sclerotic ovaries.

The remainder of the rayed ovaries all showed a normal histology, with ova in all stages of development.

In explaining the absence of well-advanced graafian follicles in some of the ovaries above mentioned, the following suggestions can be made. Both ovaries need not necessarily be in the same cycle of activity—one ovary being active and containing well-advanced graafian follicles, while the other may be in its period of rest and not producing matured ova at that particular time.

Most of the does were kept separate from the bucks and it has been shown that if the buck is withheld from the doe during several periods of œstrus, most, if not all the older, and many younger follicles, undergo degeneration. The loss of ova from this cause is so great that frequently during the remainder of the breeding season and sometimes apparently for one or more future seasons, the animal is sterile.

6. The fact that in some of the rabbits 50 milligrams of radium was used, and in others 100 milligrams, did not produce any notable difference, except that where 100 milligrams was used there was usually a greater skin reaction. The one case in which 75 milligrams was used received a very marked skin reaction, and the adhesions between the cæcum and abdominal wall were very likely due to the skin inflammation.

7. Rabbit 13 had no hair loss up to the ninth day after being rayed with 100 milligrams.

8. As to the effect on pregnancy:

a. Rabbit 5 produced a litter of normal rabbits after each ovary had received 600 milligram hours of radium.

b. Rabbit 11 failed to become pregnant after the same treatment. Microscopic examination of the ovaries showed no ova present.

c. Rabbit 13 gave birth to a litter of ten full-term rabbits on the eighth day after exposure to radium.

d. The right uterus of the guinea pig miscarried following radiation of the right ovary, though the left uterus went on with the pregnancy. The sections of the right ovary, however, were normal.

So from these experiments we feel that we are justified to conclude that 600 milligram hours of radium have no ultimate detrimental effect upon rabbit ovaries.

And from the clinical side of these observations we venture to say that when radium is given intra-uterinely for a case of menorrhagia, for example, the resulting amenorrhœa is not due to the effect of the radium upon the ovarian follicles, but to the effect upon the endometrium which receives a severe burn from the radium. If the burn be extensive enough a permanent amenorrhœa results; and if not so severe, the amenorrhœa persists for only a few months. If this theory is correct, and several of the best authorities on radium therapy are now advocating it, then much that has been written about the effect of radium will have to be rewritten, and the therapy of radium to a large extent revised.

BIBLIOGRAPHY

GRAVES, W. P. Textbook of Gynecology, 2d ed. Philadelphia: W. B. Saunders Company.

NOVAK, EMIL. Menstruation and Its Disorders. New York: D. Appleton and Company.

SIMPSON, FRANK E. Radium Therapy. St. Louis: C. V. Mosby Company.

MAURY, JOHN M. J. Am. M. Ass., lxxiv, 1711.

DANYSZ, JEAN. De l'action du radium sur les differents tissues. Compt. rend. Acad. d. sc., 1903, cxxxvii, 1296.

KANEMATSU SUGIURA and GIOACCHINE FAILLA. The effects of radium radiations on white mice. J. Gen. Physiol., iv, No. 4.

WALSH, L. S. The growth of ovarian follicles. J. Exp. M., 1917, xxvi.

HEAPE, WALTER. Ovulation and degeneration ova in the rabbit. Proc. Roy. Soc. Lond., 1905, lxxvi.

SCHMITZ, HENRY. In the discussion of Dr. Maury's article above referred to, p. 1715.

CONSERVATISM IN THE TREATMENT OF "ESSENTIAL UTERINE HÆMORRHAGE" [1]

By S. H. GEIST, M.D., F.A.C.S., New York
Associate Gynecologist and Associate in Surgical Pathology, Mt. Sinai Hospital

A LARGE group of cases, in which the most characteristic symptom is atypical uterine bleeding, has been described by many authors, including the writer. In the past 10 years, a certain number have been singled out, because of their similarity, and classified as due to disturbances of ovarian or endocrine function. They have been characterized by the absence of any definite pathological process in the uterus.

The symptomatology of this group is not always uniform, but they have sufficient in common, to warrant setting them apart as dependent on some etiological factor not due to a uterine variation. In some, the chief complaint may be a profuse menstruation with no intermenstrual bleeding. This symptom may begin with the inception of the menstrual function or may begin at any time after. The periods may last from 6 to 20 days and be so profuse as to reduce the hæmoglobin to 30 per cent or less.

There are other types in which the menorrhagia is also accompanied by metrorrhagia of rather severe grade, so that the patient gives a history of almost continuous bleeding extending over a period of weeks or months, with but a few days' interval, in which there is no hæmorrhage. There are no other symptoms of any moment.

These cases have been labeled with various names such as "chronic metritis," "fibrosis uteri," "metropathica hæmorrhagica," and "essential uterine hæmorrhage."

Undoubtedly there are differences in the groups included under these names, and it is most essential to classify them more definitely if possible; first to separate the cases from an etiological standpoint and second to group them so as to make the indications for therapy definite.

In studying the pathological material obtained from these cases it was noted that there were two constant findings, one a hypertrophied uterine mucosa and the second a cystic condition of the ovaries. The type of cysts found varied from small atretic follicles to rather large corpus luteum cysts. The ovaries vary in size from slightly above normal to twice the normal. The more detailed account of the histology will be published later.

It was suggested that the lesion in the endometrium was due to the same impulse that precipitated the bleeding and it was further suggested that the cystic condition of the ovary was at least a factor in the etiology.

In a paper published in Surgery, Gynecology and Obstetrics, August, 1920, I made mention of the fact that up to the present our methods of treatment have been most unsatisfactory. The only treatment that has been curative has been some mutilating procedure that removes the uterus or ovaries, or both, namely hysterectomy, or radiotherapy. It was hoped that by some conservative operation on the ovaries, a favorable influence on the abnormal bleeding might be obtained. It was suggested that as the ovaries were probably the seat of the abnormal stimulus, and particularly as the small cysts in them played a rôle, a wedge-shaped excision of the cyst-bearing area, involving about four-fifths of the medulla and about two-thirds of the cortex, would cure the condition. At the time of publication of the article I had had no opportunity to perform the operation, but since that time I have operated upon 9 cases, and my associates at the hospital have several additional cases each. Four of the patients upon whom I have operated I have been able to keep in touch with for about 18 months.

The following is a brief summary of these cases:

Case 1. K. S., age 28, complained chiefly of metrorrhagia and menorrhagia. Periods began at 14,

[1] From the Gynecological Department (Dr. J. Brettauer), Mt. Sinai Hospital.

were always regular until 4 years ago, since which time they have occurred every 10 days to 3 weeks. The duration is from 6 to 10 days and very profuse. There is slight pain during the early days. Patient has been married 7 years, has 2 children, and has had no miscarriages.

For the past few years patient has had menorrhagia. Periods, occur every 10 to 21 days, last 6 to 10 days, and are very profuse. Physical examination is negative except for the pelvic examination which shows bilaterally enlarged cystic ovaries.

Operation, August 29, 1920. Curettage and partial resection of both ovaries. Pathological report: Uterine mucosa shows marked hypertrophy. Ovaries microcystic with some large pea-sized cysts, mostly follicular in origin. After 5 weeks the periods returned. The first one lasted 6 days and was rather profuse. Since then the periods have returned every 4 weeks with moderate flow and no pain.

CASE 2. Y. B., age 36, complained chiefly of menorrhagia. The past history is irrelevant. Menstruation began at 13. The periods have been regular, occurring every 28 days until one year ago. Patient has been married 12 years, has 5 children, and had a miscarriage 1 year ago. For the past year the periods have occurred every 3 weeks lasting 10 days and have been very profuse in character. There has been no intermenstrual bleeding. Physical examination is negative.

Operation, August 20, 1920. Curetted. Hypertrophied endometrium was obtained. Patient was again seen 3 weeks later, when she had been bleeding for 10 days, very profusely. Examination was negative except that the left ovary was felt enlarged and cystic. Operation: Partial resection of both ovaries.

Pathological report: Right ovary normal, left ovary shows microcystic condition mostly due to follicular atresia. Several small old corpora lutea are seen. November 22, 1920, period lasted 4 days, first 2 days profuse. Since then periods have been normal, every 26 days, duration 4 days.

CASE 3. F. S., age 33, complained chiefly of metrorrhagia and menorrhagia. The past history is irrelevant. Menstruation began at 13, was of 28-day type, and of 5 days' duration. Patient had been married 11 years, has 4 children, had 2 miscarriages, the last one year ago. For the past year patient has had profuse periods lasting 10 days with occasional bleeding between periods. Physical examination is negative except for the local findings. The cervix was eroded, the uterus was enlarged uniformly to the size of a 6 weeks' gravidity.

Operation, October 18, 1920. Bilateral partial resection of ovaries. Pathological report: Microcystic ovaries of atretic follicular type with one small corpus luteum cyst.

December 10, 1920. Period was of 5 days' duration occurring 4 weeks after operation and was very scant. Since then periods have occurred every 3 weeks for 5 days and are scant in quantity.

CASE 4. J. K., age 36, complained chiefly of metrorrhagia. Past history is irrelevant. Menstruation began at 14, was of 28 day type, duration 4 days until 1 year ago. Patient had been married 17 years, has 2 children, no miscarriages. For past year patient has bled profusely for one week starting about 5 days after her regular 4-day period.

Physical examination is negative except for the local findings. There was a moderate cystorectocele. The uterus appeared normal, both ovaries, however, were slightly enlarged and cystic.

Operation, August 30, 1921. Partial resection of both ovaries.

Pathological report: Bilateral microcystic disease of the ovaries of atretic follicular type with one old corpus luteum.

Five weeks after operation period began, duration 3 days, moderate flow. This period type has been maintained up to present time.

Analyzing these cases, without attempting to classify or differentiate them, we find that in 4 cases with profuse atypical bleeding, the uterus was grossly normal, both ovaries were found to be diseased, and that by a partial resection of as much of the diseased areas as was consistent with the maintenance of function, the symptoms were relieved and a practically normal cycle was instituted.

While the number of cases reported is small and the communication is only in the form of a preliminary word, the desire to further stimulate work along this line prompted the writing of this article.

Later, a more detailed description both of the clinical and pathological aspects will be presented.

THE MORPHOLOGICAL HISTOLOGY OF ADENOCARCINOMA OF THE BODY OF THE UTERUS IN RELATION TO LONGEVITY

A Study of 186 Cases[1]

By ARTHUR E. MAHLE, M.D., Rochester, Minnesota
Fellow in Pathology, The Mayo Foundation

In this series of 186 cases of carcinoma of the body of the uterus attention has been directed especially to the study of the degree of malignancy based on the degree of cellular differentiation. The series includes only those cases observed between January 27, 1905, and January 21, 1919, in which specimens were available for study, and could be accurately demonstrated, grossly and microscopically, to be of true carcinoma. The number does not, therefore, include all cases in which hysterectomies for carcinoma of the fundus of the uterus were performed during this period.

It was noted in the records that 855 cases of carcinoma of the uterus were observed between January 1, 1910, and January 1, 1919; 70.3 per cent were in the cervix, and 29.7 per cent were in the uterus.

There are various pathological classifications of carcinoma of the uterus. Kaufmann divides them into those which arise from the surface epithelium, and the more common type, those which arise from the glandular epithelium. Under the latter he classifies first, the so-called adenoma malignum, found most often in the uterus but sometimes in the cervix. These are characterized by a slight amount of stroma, and a predominance of glandular tissue, the cells of which lie in close apposition and are highly differentiated. The second type, the usual form of adenocarcinoma of the fundus, is characterized by areas of apparent duplication of the glands of normal endometrium, while in other areas the true carcinomatous nature of the tumor is evident. The cells in the latter areas have all the morphological characteristics of carcinoma cells and are arranged in a typical gland formation. There is a moderate amount of stroma between the carcinoma cells. The third group is the papillary adenocarcinoma and in it the connective tissue stroma, as in adenoma malignum, is very sparse and the glandular tissue rests on trabeculæ of thin connective tissue. In a fourth group he places the cases of adenocarcinoma solidum in which are seen only few areas with glandular arrangement and large numbers of closely packed undifferentiated cells. The last group comprises adenocarcinomata showing, in the midst of the cylindrical cell masses, cornified cells and even epithelial pearls, not unlike those found in squamous-cell carcinoma of the cervix.

The carcinomata arising from the surface epithelium show marked variation, are very rare, and are found in older persons. The most interesting type is that which covers the entire mucosa as a squamous-cell carcinoma without glandular formation, which may or may not be cornified. The underlying tissues may be infiltrated with small celled, carcinomatous projections, and the surface may be papillary.

Ewing divides carcinoma of the uterus anatomically into a circumscribed and a diffuse group, and says that the diffuse are probably the advanced stages of the circumscribed. Histologically he follows a classification very similar to that of Kaufmann.

Under the histological types of carcinoma of the body of the uterus, Aschoff describes the adenoma malignum, adenocarcinoma, solid or medullary carcinoma, and the squamous-cell carcinoma, adding that in the same carcinoma one or even all types may be present.

Cullen does not divide carcinoma of the uterus into definite groups. He asserts that, while all cases may be grouped under one main heading, the grouping varies greatly in individual cases. He is of the opinion that if the papillary arrangement is the most marked, the origin of the tumor is from the surface epithelium; whereas, when the gland-like arrangement predominates, the process has started first in the glands.

[1] Abridgment of thesis submitted to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Pathology, April, 1922.

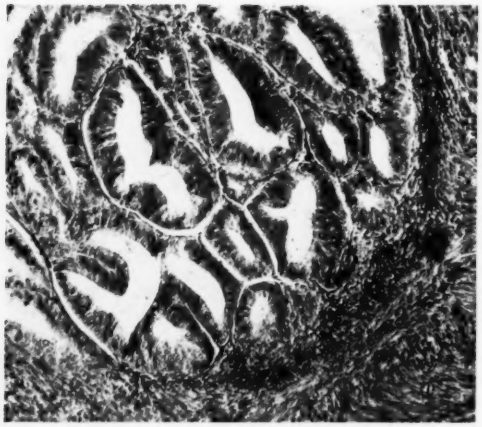


Fig. 1. Photomicrograph of adenocarcinoma, Grade 1, showing secondary cellular differentiation. (Case A146326.)

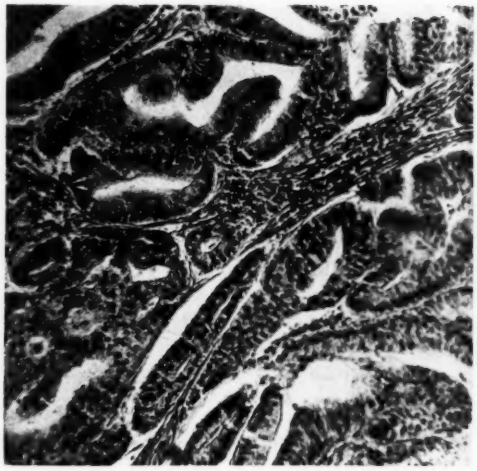


Fig. 2. Area of an adenocarcinoma showing secondary cellular differentiation. (Case A59495.)

No special attempt has been made to classify anatomically the cases in this series other than to note the general shape, extent of involvement of the uterine cavity, and invasion of the myometrium in relation to the histological type. From the histological appearance, an attempt has been made to prognosticate the relative degree of malignancy or mortality of a group of cases, taking as a basis the cellular changes. That there are other factors, cannot be denied; such as the rate and extent of growth manifested in the amount of uterine cavity involved, the degree of invasion of the myometrium, the late involvement of lymph nodes, and also the uncertain factor, personal resistance to carcinoma. Many of these factors are not recorded. Cellular differentiation alone does not explain the high mortality of certain carcinomata the cells of which were well differentiated, or the long duration of postoperative life of other patients whose carcinomata were histologically highly malignant. Taken as a whole, however, cellular differentiation appears to be the most important factor.

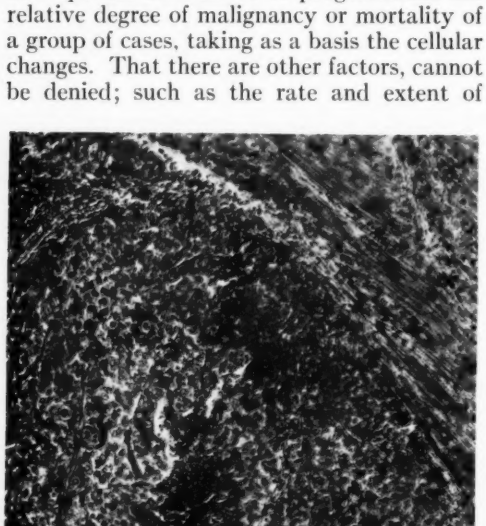


Fig. 3. Photomicrograph showing primary cellular differentiation predominating. (Case A124544.)

Each case of the series was studied separately. MacCarty's standard of cellular differentiation was followed. Cells arranged with regard to the general direction of adult tissue or with normal polarity, with normal appearance of cytoplasm and nucleoplasm, and with normal function, that is, completely differentiated, are grouped as showing tertiary differentiation, expressed as Differentiation 3. Differentiation 2 consists of the establishment of tissue polarity but morphological undifferentiation of cells (Figs. 1 and 2). Primary differentiation consists of morphological undifferentiation of cells but alignment according to the general direction of adult tissue (Fig. 3). Thus cells showing no differenti-

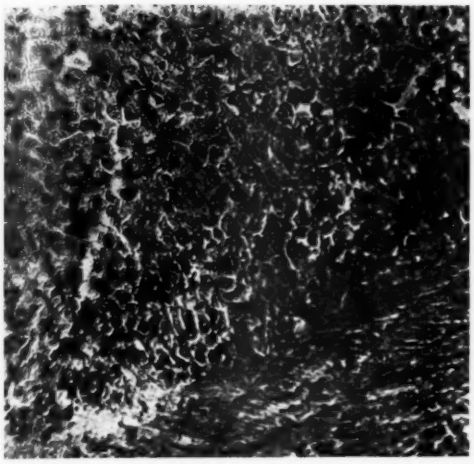


Fig. 4. Photomicrograph of an adenocarcinoma, Grade 4. (Case A190227.)

tion, Differentiation o, have neither morphoiogical differentiation nor alignment (Figs. 4 and 5).

Appreciating that the degree of malignancy ls dependent on the phenomenon of cellular differentiation, the foregoing types were also incorporated into different grades of malignancy, Grades 1, 2, 3, and 4, similar to Broders' classification of squamous-cell epitheliomas (Figs. 1 to 5). Grade 4 represents highly malignant cases in which the cells show Differentiation o throughout practically the entire tumor, although occasional areas may show some primary differentiation (Fig. 5). Grade 3 includes carcinomata showing largely Differentiation o, some primary differentiation, and occasional areas may show secondary differentiation (Fig. 3). Grade 2 carcinomata show a predominance of secondary differentiation throughout, and occasional areas of primary differentiation (Fig. 2). Grade 1 comprises early cases, in which the carcinoma is extremely small and the cells show high differentiation, secondary throughout (Fig. 1).

The average age of the 186 patients was fifty-five and one-hundredth years, the oldest was seventy-three and the youngest twenty-one (Table I). This bears out statistical data in the literature with regard to the insignificant

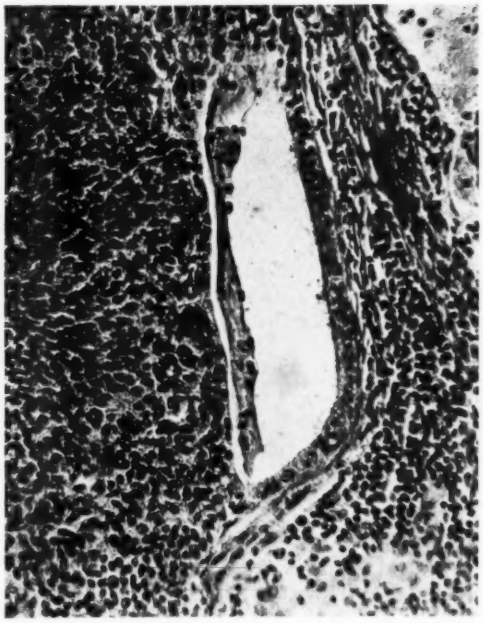


Fig. 5. Photomicrograph of an adenocarcinoma whose cells, having no differentiation, completely surround a normal uterine gland. (Case A274079.)

mortality from carcinoma of the female genital organs before the age of 25 years. Occasional cases of carcinoma of the uterus are cited in the literature in persons younger than 20 years, but the authenticity of most of these is severely questioned. Ganghofner reports a case of cancer of the portio in a girl of 8 years. This case, according to Williams, is not a true carcinoma but a cauliflower excrescence of epithelial hyperplasia; although Chiari examined the tumor histologically, and his report should be authentic. Cragin reports a case of carcinoma of the uterus in a girl of 18 years, on whom a radical abdominal hysterectomy was performed, and recurrence had not taken place during a period of 5 months. In the series of adenocarcinomata of the uterus collected by Cullen the two youngest patients were 30 years.

The average age of patients in the series at menopause was 48.8 years, showing that catamenia is relatively not altered in patients with carcinoma of the uterus (Table I). In

Fig. 6. Papillary type of adenocarcinoma of the body of the uterus cut in sagittal section showing extensive invasion of the myometrium. (Case A91620.)

Fig. 7. Papillary type of adenocarcinoma of the body of the uterus associated with fibromyomata. (Case A146326.)

comparison to the average age, fifty-five and one-hundredths years, one is led to believe that a certain etiologic relation exists between decline of functional activity and malignant disease, and that the liability to cancer increases as the decline of function progresses. This fact is further emphasized when we compare the active marital lives of these patients, with regard to the number of pregnancies, with otherwise normal patients (Table I).

The longest duration of symptoms occurred in cases of Grades 2 and 3; the longest average duration of symptoms was in the least malignant, Grade 1, and the shortest average duration of symptoms in the most malignant, Grade 4 (Table III). This difference when compared with the extent of involvement of the uterine cavity and the amount of invasion of myometrium (Fig. 6) with regard to the degree of malignancy and cellular differentiation (Tables VI and VIII), illustrates that a tumor of a high degree of malignancy and low cellular differentiation grows larger and invades more extensively in the same period of time, than a tumor of a lower degree of malignancy, and high cellular differentiation. The amount of invasion of the myometrium is designated as

TABLE I.—ADENOCARCINOMA OF THE BODY OF THE UTERUS: 186 CASES FROM JANUARY 27, 1905, TO JANUARY 1, 1919

	Years	Number	Per cent
Patients		186	
Age:			
Youngest	21		
Oldest	73		
Average	55.01		
Family history of malignancy		29	15.59
Single		18	9.63
Married		168	90.33
Never pregnant		63	33.87
Total pregnancies		123	66.12
Pregnancies for each married patient		2.4	
Patients having had miscarriage		53	28.49
Total miscarriages		75	
Miscarriages for each married patient		0.43	
Menopause:			
Youngest	35		
Oldest	55		
Average	48.8		

TABLE II.—GRADES OF CELLULAR DIFFERENTIATION

	Cases	Per cent
Grade 1	10	5.37
Grade 2	114	61.29
Grade 3	54	29.03
Grade 4	8	4.30

TABLE III.—DURATION OF SYMPTOMS ACCORDING TO GRADE OF MALIGNANCY

	Grade 1, years	Grade 2, years	Grade 3, years	Grade 4, years	All grades, years
Longest	4.0	5.0	4.0	3.0	5.0
Shortest	0.08	0.08	2.5	2.5	0.08
Average	1.57	1.25	1.42	1.0	1.29

Fig. 8. Polypoid type of adenocarcinoma of the body of the uterus originating in the right horn. (Case A341145.)

Fig. 9. Polypoid type of adenocarcinoma of the body of the uterus of high degree of malignancy. (Case A145635.)

Grades 1, 2, 3, and 4; Grade 1 denotes microscopic involvement of the muscle; Grade 2, invasion of one-half of the approximate width of the muscle; Grade 3, invasion to the serosa, and Grade 4, invasion of all the muscle layer and the serosa.

The clinical symptoms (Table IV) illustrate that vaginal discharge, especially if blood tinged, is the most out-standing feature, occurring in 92.46 per cent of all cases. Loss of weight and strength occupy the next place of importance, while odorous discharge except in advanced cases is of relatively little diagnostic value.

Sixty-one and twenty-nine hundredths per cent of the 186 cases are in Grade 2; 29.03 per cent are in Grade 3 (Table II). In comparison, squamous-cell carcinomata of the cervix, graded similarly by Broders, are more malignant; the larger number of his cases fall into Grades 3 and 4. The number of patients obtaining good postoperative results in Broders' series was 20 per cent, while in this series 61.02 per cent of the patients heard from were still living and the proportion of good postoperative results following vaginal and abdominal hysterectomy was 52.94 per cent and 58.71 per cent respectively. If only the two most malignant grades of carcinoma of the uterus, Grades 3 and 4, are considered, only 35.55 per cent of the patients heard from are living, and good results were obtained in only 32 per cent of the patients operated on. If the larger number of cases of Grade 4 of the squamous-cell carcinomata of the cervix are considered, the difference in percentage of good postoperative results in the two types is further equalized. The differences in life expectancy between the two types of uterine carcinoma and in carcinomata found elsewhere, may possibly be explained by their differences in the degree of malignancy based

TABLE IV.—SYMPTOMS

	Cases	Per cent
Vaginal discharge	182	98.38
Bloody vaginal discharge	172	92.46
Odorous vaginal discharge	53	28.49
Tissue passed	2	1.07
Weight loss (average 20.29 pounds)	44	23.65
Loss of weight and strength (amount not stated)	64	34.40

TABLE V.—ASSOCIATED FIBROMYOMATA, 57 CASES

	Cases	Per cent
Grade 1	5	55.55 of 9
Grade 2	30	30.30 of 99
Grade 3	19	42.22 of 45
Grade 4	3	37.5 of 8
Total	57*	35.4 of 161

*Only this number was available for this study.

TABLE VI.—RELATION OF VARIOUS FACTORS TO GRADE OF MALIGNANCY EXTENT OF INVOLVEMENT OF UTERINE CAVITY, EXPRESSED IN FIFTHS

Involvement	Grade 1		Grade 2		Grade 3		Grade 4		All Grades	
	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent
1/5	4	44.44 of 9	17	17.00 of 100	4	8.88 of 48			25	15.53 of 162*
2/5	3	33.33 of 9	13	13.00 of 100	4	8.88 of 48	1	12.50 of 8	21	12.96 of 162
3/5			12	12.00 of 100	9	20.00 of 48	1	12.50 of 8	22	13.58 of 162
4/5	2	22.22 of 9	34	34.00 of 100	15	33.33 of 48	1	12.50 of 8	52	32.09 of 162
5/5			24	24.00 of 100	13	28.88 of 48	5	62.50 of 8	42	25.93 of 162
Grade	INVASION OF MYOMETRIUM									
1	6	66.66 of 9	27	27.27 of 99	7	15.55 of 45	1	12.50 of 8	41	25.46 of 161*
2	3	33.33 of 9	36	36.36 of 99	16	35.55 of 45	3	37.50 of 8	56	34.78 of 161
3			23	23.23 of 99	10	22.22 of 45			35	21.73 of 161
4			13	13.13 of 99	12	26.66 of 45	4	50.00 of 8	29	18.01 of 161
	SHAPE OF LESION									
Papillary	4	44.44 of 9	78	78.78 of 99	31	68.88 of 45	4	50.00 of 8	118	73.29 of 161*
Diffuse	1	11.11 of 9	12	12.12 of 99	10	22.22 of 45	2	25.00 of 8	25	15.52 of 161
Polypoid	4	44.44 of 9	9	9.09 of 99	4	8.88 of 45	2	25.00 of 8	18	11.18 of 161
Grade	LYMPHOCYTIC REACTION									
1	7	70.00 of 10	45	39.50 of 114	23	42.59 of 54	3	37.50 of 8	78	41.93 of 186
2	3	30.00 of 10	47	41.22 of 114	21	38.88 of 54	2	25.00 of 8	73	39.24 of 186
3			20	17.62 of 114	10	18.51 of 54	3	37.50 of 8	33	17.74 of 186
4			2	1.75 of 114					2	1.07 of 186
Differentiation	CELLULAR DIFFERENTIATION									
0							3	37.50 of 8	3	1.61 of 186
1			2	1.75 of 114	30	55.55 of 54	5	62.50 of 8	37	19.87 of 186
2			112	98.24 of 114	24	44.44 of 54			146	78.49 of 186

*Only this number (of 186 cases) were available for this study.

on the cellular differentiation. Such factors as the lymph drainage, mode and extent of invasion, and rapidity of growth may be secondary to, and perhaps to a degree dependent on, cellular differentiation, and in reality of little real importance with regard to the potential malignancy of the carcinoma.

Taussig found that of forty-five cases of carcinoma of the fundus of the uterus, ten (25 per cent) were associated with fibromyomata. The percentage in this series is somewhat higher for the reason that it includes even the most minute intramural fibromyoma (Table V). That this is a factor in the etiology of carcinoma can hardly be accepted when compared with the number of fibromyomata found in non-malignant uteri at hysterectomy and the overwhelming number of fibromyomatous uteri compared with carcinomatous uteri.

TABLE VII.—CELLULAR DIFFERENTIATION OF 186 CASES

	Cases	Per cent
Differentiation 0	3	1.61
Differentiation 1	37	19.89
Differentiation 2	146	78.49

The shapes of the lesions (Tables VI and VIII) to a certain extent appear to be dependent on cellular differentiation. The carcinomata in the least malignant group and those showing the greatest differentiation were largely papillary or polypoid in shape (Figs. 7, 8, and 9), while the most malignant and those showing the least cellular differentiation were those designated as the diffuse or flat type (Fig. 10), as distinguished from the papillary or polypoid types which are raised above the surface of the uterine mucosa. In carcinomata of the bladder, those of the papillary type are less malignant than the flat type. However, other factors, such as mechanical pressure, play a part in determining shape, especially in tumors growing in cavities. Likewise polypoid tumors are surface tumors arising from a local hyperplasia which tends to be non-invasive.

In the general ultimate results according to the four grades of malignancy (Table VIII) all patients with Grade 1 malignancy are still living, while those with Grade 4 malignancy are dead. Referring to the cause of death of these patients (Table XII), 75 per cent died of

carcinoma. Of patients with Grade 2 malignancy, 71.76 per cent are still alive, while in Grade 3, only 38.09 per cent are alive. The cause of death due to carcinoma in these two groups is 62.06 per cent and 74.19 per cent, respectively. Thus not only the number of patients dead increases as the degree of malignancy increases, but the number of deaths due to carcinoma increases.

These facts are likewise verified in a consideration of the ultimate results of the cases grouped on a basis of cellular differentiation. The highest, Differentiation 2, showed the largest percentage of living patients (65.78 per cent) and the smallest number dead (34.21 per cent); while the next group showing primary differentiation as the highest degree of cellular differentiation had the smallest number of living patients (36.36 per cent), and the largest number dead (63.63 per cent) (Table XII). The average duration of symptoms and the average length of postoperative life are somewhat longer in the group showing the highest cellular differentiation.

Abdominal hysterectomy was performed on 136 (73.11 per cent) of the 186 patients, while forty-five (24.19 per cent) had vaginal hysterectomies (Table X). More than one-half of the patients who were thus treated had good results, and are living, or death has resulted from some cause other than carcinoma. The

Fig. 10. Diffuse type of adenocarcinoma of the body of the uterus associated with fibromyomata. (Case A335600.)

TABLE VIII.—RELATION OF VARIOUS FACTORS TO CELLULAR DIFFERENTIATION EXTENT OF INVOLVEMENT OF UTERINE CAVITY, EXPRESSED IN FIFTHS

	Differentiation 0		Differentiation 1		Differentiation 2		Total	
	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent
1/5			2	6.66 of 30	22	17.18 of 128	24	14.90 of 161*
2/5			5	16.66 of 30	17	13.28 of 128	22	13.66 of 161
3/5			7	23.33 of 30	16	12.50 of 128	23	14.28 of 161
4/5			7	23.33 of 30	45	35.15 of 128	52	32.29 of 161
5/5	3	100 of 3	9	30.00 of 30	28	21.87 of 128	40	24.84 of 161
Grade			INVASION OF MYOMETRIUM					
1			5	16.66 of 30	36	28.12 of 128	41	25.46 of 161*
2	1	33.33 of 3	11	36.66 of 30	46	35.93 of 128	58	36.02 of 161
3			6	20.00 of 30	27	21.09 of 128	33	20.49 of 161
4	2	66.66 of 3	8	26.66 of 30	19	14.84 of 128	29	18.01 of 161
			SHAPE OF LESION					
Papillary	1	33.33 of 3	16	53.33 of 30	101	78.90 of 128	118	73.29 of 161*
Diffuse	2	66.66 of 3	8	26.66 of 30	15	11.71 of 128	25	15.52 of 161
Polypoid			6	20.00 of 30	12	9.37 of 128	18	11.18 of 161
Grade			LYMPHOCYTIC REACTION					
1	1	33.33 of 3	14	37.83 of 37	63	43.15 of 146	78	41.93 of 186
2	1	33.33 of 3	14	37.83 of 37	58	39.72 of 146	73	39.24 of 186
3	1	33.33 of 3	8	21.62 of 37	24	16.43 of 146	33	17.74 of 186
4			1	2.70 of 37	1	0.68 of 146	2	1.07 of 186

*Only 161 cases were available for this study.

TABLE IX.—CLINICAL DIAGNOSES IN 186 CASES OF CARCINOMA OF BODY OF UTERUS

	Cases	Per cent
Definite	75	40.32
Questionable	36	19.35
Diagnosed other than carcinoma of uterus	68	36.55
Diagnosis not recorded	7	3.76

TABLE X.—SURGICAL TREATMENT

	Cases	Per cent
Total abdominal hysterectomy with removal of tubes and ovaries	128	68.81
Subtotal abdominal hysterectomy with removal of tubes and ovaries	8	4.30
Vaginal hysterectomy with removal of tubes and ovaries	7	3.76
Vaginal hysterectomy	38	20.43
Curettage	4	2.14
Cautery	1	0.53

TABLE XI.—CAUSE OF DEATH OF PATIENTS WHO DIED AT THE CLINIC

	Cases	Per cent
Peritonitis	5	2.68
Myocardial degeneration	2	1.07
*Pneumonia	1	0.53
Intestinal obstruction	2	1.07
Pulmonary embolism	1	0.53
Operative mortality	11	5.91

*One death from pneumonia followed thyroidectomy one year after hysterectomy for carcinoma of the uterus.

good results in both vaginal and abdominal hysterectomy decrease in percentage as the degree of malignancy increases. With this decrease in percentage of living patients with good results there is a corresponding increase in deaths from operation and recurrence.

It is of interest that in this series vaginal hysterectomy shows a slight increase in the percentage of recurrence both in the number of living patients with recurrence and in the percentage of carcinoma deaths (Table XII). Operative death rate is slightly higher in cases in which abdominal hysterectomies have been performed while the percentage of good postoperative results is somewhat higher than in vaginal hysterectomy.

The classification of cases according to the highest cellular differentiation found throughout the carcinomata, and the grouping according to grades show no difference in the total ultimate results. The latter grouping perhaps gives the pathologist a somewhat larger scope. However, the foregoing facts demonstrate that the postoperative prognosis of a group

TABLE XII.—GENERAL ULTIMATE RESULTS ACCORDING TO DEGREE OF MALIGNANCY

Patients traced ..... 136 (73.11 per cent of 186)

	Grade 1		Grade 2		Grade 3		Grade 4		All Grades	
	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent
Patients living	6	100 of 6	61	71.76 of 85	16	38.09 of 42			83	61.02 of 136
Postoperative life		Years		Years		Years				Years
Longest		2.18		15.63		14.39				15.63
Shortest		3.51		3.005		3.35				3.005
Average		7.24		7.27		7.05				7.23
Patients dead (cause other than operation)			24	28.23 of 85	26	61.90 of 42	3	100 of 3	53	38.97 of 136
Postoperative life				Years		Years		Years		Years
Longest				10.76		13.66		1.23		13.66
Shortest				0.33		0.106		0.082		0.082
Average				2.96		1.91		0.759		2.29

ACCORDING TO CELLULAR DIFFERENTIATION

	Differentiation 1		Differentiation 2		Total	
	Cases	Per cent	Cases	Per cent	Cases	Per cent
Patients living	8	36.36 of 22	75	65.78 of 114	83	61.02 of 136
Postoperative life		Years		Years		Years
Longest		11.51		15.66		15.66
Shortest		4.35		3.005		3.005
Average		6.51		7.30		7.23
Patients dead (cause other than operation)	14	63.63 of 22	39	34.21 of 114	53	38.97 of 136
Postoperative life		Years		Years		Years
Longest		13.66		10.76		13.66
Shortest		0.106		0.106		0.106
Average		0.027		2.36		2.27

TABLE XII.—CONTINUED

CAUSE OF DEATH*

	Grade 1		Grade 2		Grade 3		Grade 4		All Grades	
	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent
Carcinoma			18	62.06 of 29	23	74.19 of 31	3	75.00 of 4	44	67.69 of 65
Carcinoma (?)			1	3.44 of 29	1	3.22 of 31			2	3.07 of 65
Operation	1	100 of 1	4	13.79 of 29	5	16.12 of 31	1	25.00 of 4	11	16.91 of 65
Other than carcinoma			4	13.79 of 29	1	3.22 of 31			5	7.69 of 65
Unknown			2	6.89 of 29	1	3.22 of 31			3	4.61 of 65
Total									65	43.91 of 148

PATIENTS WHO HAD ABDOMINAL HYSTERECTOMIES (136 CASES)

Patients from whom information was received									109	80.14 of 136
Patients from whom information was not received									27	19.85 of 136
Living:										
Good results	3	75.00 of 4	46	65.64 of 68	12	35.29 of 34			61	55.96 of 109
Recurrence			1	1.47 of 68					1	0.91 of 109
Patients dead from operation	1	25.00 of 4	3	4.41 of 68	4	11.76 of 34	1	33.33 of 3	9	8.25 of 109
Other causes			3	4.41 of 68					3	2.75 of 109
Carcinoma			13	19.11 of 68	16	47.05 of 34	2	66.66 of 3	31	28.44 of 109
Unknown			2	2.94 of 68	2	5.88 of 34			4	3.66 of 109

PATIENTS WHO HAD VAGINAL HYSTERECTOMIES (45 CASES)

Patients from whom information was received									34	75.56 of 45
Patients from whom information was not received									11	24.44 of 45
Living:										
Good results	1	100 of 1	13	65.00 of 20	3	25.00 of 12			17	50.00 of 34
Recurrence			1	5.00 of 20					1	2.94 of 34
Patients dead from operation			1	5.00 of 20	1	8.33 of 12			2	5.88 of 34
Other causes					1	8.33 of 12			1	2.94 of 34
Carcinoma			4	20.00 of 20	7	58.33 of 12	1	100 of 1	12	35.29 of 34
Unknown			1	5.00 of 20					1	2.94 of 34

PATIENTS WHO HAD ABDOMINAL HYSTERECTOMIES (136 CASES)

	Differentiation 0		Differentiation 1		Differentiation 2		Total	
	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent
Patients from whom information was received							109	80.14 of 136
Patients from whom information was not received							27	19.85 of 136
Living:								
Good results			5	25.00 of 20	56	63.63 of 88	61	55.96 of 109
Recurrence					1	1.13 of 88	1	0.91 of 109
Patients dead:								
From operation	1	100 of 1	4	20.00 of 20	4	4.54 of 88	9	8.25 of 109
Other causes					3	3.40 of 88	3	2.75 of 109
Carcinoma			9	45.00 of 20	22	25.00 of 88	31	28.44 of 109
Unknown			2	10.00 of 20	2	2.27 of 88	4	3.66 of 109

PATIENTS WHO HAD VAGINAL HYSTERECTOMIES (45 CASES)

Patients from whom information was received							36	75.56 of 45
Patients from whom information was not received							11	24.44 of 45
Living:								
Good results			2	33.33 of 6	15	53.57 of 28	17	50.00 of 34
Recurrence					1	3.57 of 28	1	2.94 of 34
Patients dead:								
From operation			1	16.66 of 6	1	3.57 of 28	2	5.88 of 34
Other causes			1	16.66 of 6			1	2.94 of 34
Carcinoma			2	33.33 of 6	10	35.71 of 28	12	35.29 of 34
Unknown					1	3.57 of 28	1	2.94 of 34

* Information received from relative, home physician, or other reliable source.

of patients with adenocarcinoma can be determined by a close study of the cellular differentiation of the carcinoma.

CONCLUSIONS

1. The mortality and frequency of carcinoma of the body of the uterus rank within the first two places in carcinoma in the female. Such carcinoma is extremely rare before the age of twenty-five years.

2. Carcinoma of the body of the uterus is found in about 30 per cent of all uterine carcinomata.

3. Apparently a definite relation exists between the decline of functional activity and malignant disease of the body of the uterus.

4. The more active the carcinoma, the shorter the clinical symptoms.

5. Vaginal discharge, especially if blood tinged, is the most outstanding clinical feature of carcinoma of the uterus.

6. The accepted belief of a relatively favorable outlook for carcinoma of the body of the uterus in comparison to carcinoma of the cervix has a pathological basis in that the number of cases which show a high degree of differentiation are in the majority, and the more malignant types are rare.

7. Association of fibromyomata with carcinoma of the uterus does not appear to play an important part in the etiology.

8. The shape of the lesion appears to be related to the degree of cellular differentiation, for the more malignant the carcinoma, the less liable it is to assume a papillary form.

9. A carcinoma of a high grade of malignancy grows larger and invades more extensively in a given length of time, than one of a lower degree of malignancy. Lymphocytic reaction appears more marked in groups showing a higher degree of malignancy.

10. The clinical diagnosis of carcinoma of the body of the uterus, before curettage or hysterectomy, is possible in 40 per cent of all cases.

11. The longest length of life since operation of those patients who are now dead occurred in cases of Grade 2 malignancy, while the shortest occurred in Grade 4. The greatest average length of life since operation of those patients who are now living occurred in cases of Grade 2 malignancy, and the shortest in Grade 3. None of the patients with Grade 4 malignancy are now living.

12. The shortest length of life since operation of those patients who are now dead occurred in Grade 4 and the longest in Grade 2.

13. The shortest average length of life following operation of patients who are now dead occurred in Grade 4 and the longest in Grade 2. Grade 1 contained no patients who are now dead.

14. Grade 1 contains the largest percentage of living patients and Grade 4 contains none, while Grades 2 and 3 contain 71.76 per cent and 38.09 per cent, respectively.

15. The largest percentage of deaths from carcinoma occurs in Grade 4 and a smaller percentage in each group to Grade 1, in which there have been no deaths from carcinoma.

16. Abdominal hysterectomy in this series of cases was performed more often than vaginal hysterectomy and the incidence of postoperative good results among living patients is slightly higher among those having abdominal hysterectomy. The percentage of recurrence is slightly higher in vaginal hysterectomy.

17. The sum total of ultimate results shows practically no variation when interpreted from a basis of relative amount of a definite type of cellular differentiation present in the tumor expressed in Grades 1 to 4, than when the interpretation depends on the highest type of differentiation present in the tissue.

18. A series of adenocarcinomata of the uterus can be so classified according to groups, expressing various degrees of malignancy, that the ultimate postoperative results obtained will vary in direct proportion to the mortality of each group.

BIBLIOGRAPHY

1. Aschoff, L. Pathologische Anatomie. Jena: Fischer, 1919, ii, p. 666.
2. Broders, A. C. Squamous-cell epithelioma of the lip. J. Am. M. Ass., 1920, lxxiv, 656–664.
3. Idem. Epithelioma of the genito-urinary organs. Ann. Surg., 1922, lxxv, 574–604.
4. Cragin, E. B. Case of carcinoma of the uterus in a girl of eighteen years. Am. J. Obst., 1913, lxvii, 144–145.
5. Cullen, T. S. Cancer of the Uterus. Philadelphia: W. B. Saunders & Co., 1909, 693 pp.
6. Ewing, J. Neoplastic Diseases. Philadelphia: W. B. Saunders & Co., 1919, p. 523.

7. GANGHOFNER, F. Ein Fall von Carcinoma uteri bei einem achtjaehrigen Maedchen. Ztschr. f. Heilk., 1888, ix, 337–346.
8. KAUFMAN, E. Speciellen pathologischen Anatomie. Berlin: Reimer, 1911, ii, 1030–1031.
9. MACCARTY, W. C. A biological conception of neoplasia, etc. Am. J. M. Sc., 1919, clvii, 657–674.
10. SCHOLL, A. J., JR. Histology and mortality of tumors of the bladder. Surg., Gynec. & Obst., 1922, xxxiv, 189–198.
11. TAUSSIG: Personal communication.
12. WILLIAMS, W. R. The Natural History of Cancer. New York: William Wood & Co., 1918, pp. 378, 381.

LINGUAL GOITER

BY FRANK H. LAHEY, M.D., F.A.C.S., BOSTON

THE origin of the thyroid gland is from a single median projection of entoderm from the floor of the upper gut. The anlage occupies the aboral position of a groove between both halves of the second branchial arch. Later this groove is replaced by an oval tubercle called tuberculum thyroideum, at which time the anlage begins to grow downward, the surface of the floor of the mouth becoming deepened and now presenting the foramen cæcum. This remnant represents in the fully developed body the original location of the fœtal thyroid and the entrance of the tube by which it was originally connected with the intestinal tract (upper gut). The single anlage of the tongue, tuberculum linguale mediale, appears much later as a tubercle between the first and second branchial arches and is to be distinguished from the lateral anlagen of the tongue.

The anlage of the thyroid during its development in man descends to its ultimate position on the upper tracheal rings, remaining connected by means of the thyroglossal duct behind with its origin, the point of entrance of the duct being the foramen cæcum. Below it sends out projections of cells, like an alveolar or tubulo-alveolar gland, which form the lateral lobes of the thyroid.

The thyroglossal duct is divided in the second month of intra-uterine life into the superior and inferior portions—the superior extending from the hyoid bone to the foramen cæcum and the inferior portion from the hyoid bone to the isthmus of the thyroid or its pyramidal lobe. This division is brought about by the later development of the hyoid bone, the duct at times being in front of the hyoid, sometimes passing through the hyoid, but usually behind it. These possible locations of the thyroglossal tract are of importance in dealing surgically with persistent and discharging thyroglossal ducts.

With the point of origin of the thyroid in mind, the course of its descent and the knowledge that the thyroglossal tract often persists from the foramen cæcum to the isthmus of the thyroid, the development of masses of thyroid tissue at (1) the foramen cæcum, lingual goiter, (2) within the root of

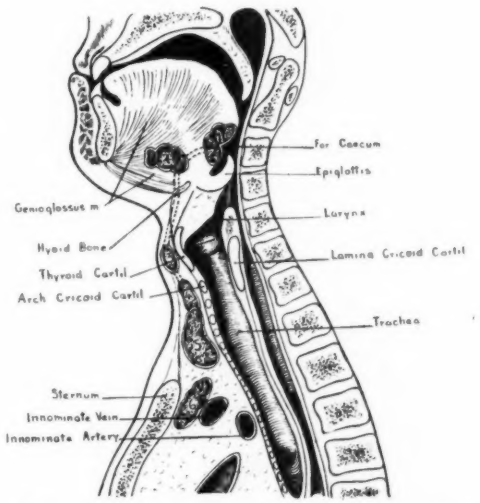


Fig. 1. Diagram showing places at which accessory thyroids may develop. (Course of thyroglossal duct shown by dotted line.) (1) In the region of foramen cæcum; (2) intralingual; (3) prelaryngeal; (4) pyramidal process; (5) normal thyroid; (6) accessory retrosternal thyroid.

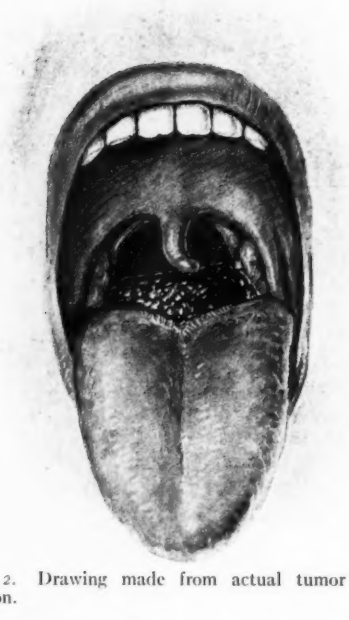


Fig. 2. Drawing made from actual tumor before operation.

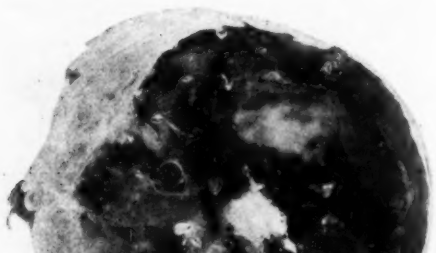


Fig. 3. Photograph of specimen.

the tongue, intralingual goiter, (3) in front of the larynx, prelaryngeal goiter, (4) in the normal location of the thyroid, and (5) as a retrosternal accessory goiter, is readily understood. These latter accessory retrosternal masses of thyroid tissue are said by Corning[1] to be offspring tissue of the thyroid gland which have continued the downward descent of the anlage until they become located in the superior mediastinum behind the sternum.

Lingual goiter, therefore, as may be understood from the foregoing remarks, is the result of development of thyroid tissue at the point of origin of the thyroid. The tumor of the tongue is, of course, present at birth, but as a rule is not of sufficient size to produce symptoms. With increasing years enlargement of the mass occurs until, as in our own case, advice is sought because the tumor, on account of its size, interferes with swallowing and nutrition. The patient complains of the presence of a lump in the back of the throat which on examination appears as a firm, solid tumor located in the midline on the posterior third of the tongue, its surface being dull red in color, slightly lobulated in contour, and bleeding easily if abraded; its base is broad, extending, as a rule, well out close to either edge of the tongue. Because of the mechanical interference with articulation due to the presence of the mass, a definite impairment of speech is produced. Such is the condition in a lingual goiter.

In the case of the intralingual goiter, the condition is very similar, except that it may grow downward into the floor of the mouth.

The treatment is obviously surgical removal when mechanical difficulties in swallowing result from its presence. This may be accomplished in the lingual type by excision through the mouth, care being taken to obtain adequate exposure of the tumor by delivery of the posterior third of the tongue and careful control of bleeding during excision of the mass from the tongue. These two precautions are of extreme importance, owing to the vascularity of the tumor and its inaccessibility except under very complete anæsthesia.

Intralingual goiters arising within the substance of the tongue are reached either through the tongue by way of the mouth, or from the outside, through the floor of the mouth, depending upon whether they are

[1] H. K. Corning. Lehrbuch der Entwicklungsgeschichte des Menschen, 1921, p. 290.

located close to the mucous membrane of the tongue or well within the substance of the root of the tongue.

The question naturally arises in these conditions as to whether the removal of the lingual goiter will or will not produce myxœdema or tetany. Tetany will not be produced, since the parathyroids possess developmental centers which are entirely independent and separate from that of the thyroid.

The development of myxœdema must always be a possibility, dependent upon whether the lingual goiter represents the development of accessory thyroid tissue in the course of the thyroid tract, or whether it represents the entire undescended thyroid remnant, as apparently was the fact in our case. With the possibility of myxœdema in mind, careful pre-operative and postoperative metabolism estimations should be made, in order that thyroid feeding may be instituted at once upon the appearance of a markedly decreased metabolic rate.

Miss Alice G., age 25, Fall River, Massachusetts. Referred by Drs. G. L. Richards and Jeannette M. Shefferd, Fall River.

The general history and physical examination being negative except for attacks of recurrent appendicitis, are not reported.

Since birth, patient had had a tumor at the base of the tongue. It had gradually increased in size until at the time of examination it was as large as an egg, interfering with swallowing and seriously influencing nutrition. It was located at the posterior third of the tongue at about the situation of the foramen cæcum, and extended back almost to the epiglottis. It was not pedunculated, but had a broad base and was of lobular contour. Its consistency was firm and it was freely movable.

Excision through the mouth was advised, a pre-operative diagnosis of lingual goiter having been made. The pre-operative basal metabolic rate was +2. Operation at the New England Deaconess Hospital on September 2, 1921. Intra-tracheal anæsthesia, Dr. Sise.

Stitches of silk were introduced well back on either side of the tongue and traction made on these until the posterior third of the tongue with the tumor on it was delivered well out into the mouth.

The tumor was then removed from the tongue by wedge-shaped excision, bleeding being carefully controlled by clamps before any portion was cut away. The snaps were then tied with single No. 0 chromic catgut and the mucous membrane of the tongue brought over the defect.

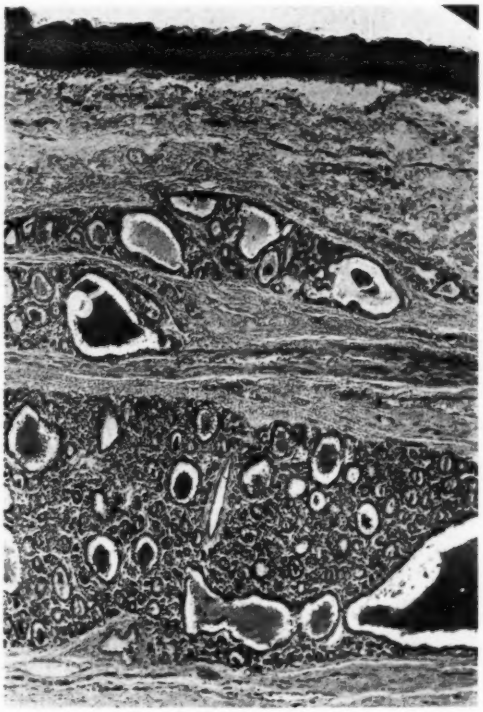


Fig. 4. Histological section of lingual goiter (described in case report).

The patient made an uneventful recovery, but it is of interest to note that on September 14, 1921, 12 days after the operation, her metabolism rate had dropped to −18. She was immediately put upon thyroid feeding, with the result that on November 17, 1921, 2 months later, her metabolism rate had risen to +19.

We again estimated her metabolic rate on July 11, 1922, after thyroid feeding had been omitted for some time. It was found to be −15. The persistent hypothyroidism makes it probable that the lingual thyroid in this case represented the entire undescended thyroid gland.

PRIMARY OSTEOMYELITIS OF THE PATELLA

Report of a Case and a Review of the Literature

By VICTOR E. CHESKY, M.D., Halstead, Kansas

PATELLAR infections of any kind are uncommon, and acute primary osteomyelitis, the infection entering by the hæmatogenous route, is a very rare occurrence.

J. Ducuing, in 1911, reported 73 cases of patellar osteitis collected from the literature in which 50 were tubercular, 2 being bilateral, 15 were spontaneous, 5 traumatic, and 3 syphilitic. His distinction between the spontaneous and the traumatic was that, in the former, the infection was hæmatogenous and in the latter it was carried directly into the patella by trauma. In Gangolfes statistics there are 661 cases of osteomyelitis, 610 of the long bones, 51 of the short and flat bones and none of the patella. Trendel in the Tuebingen clinic, up to 1904, saw 1058 cases of osteomyelitis, 169 of the short and flat bones and only one of the patella. H. Walther reported 2 cases of patellar osteomyelitis in Lexer's clinic from 1910 to 1916. Creite in 1906 reported one case in the Goettingen clinic since 1896, a period of 10 years. Roepke, in the Jena clinic, between 1889 and 1904, reported 8 cases of tubercular osteitis of the patella and only 2 of suppurative osteomyelitis. Konig reported 281 cases of tuberculosis of the knee-joint with 32 involving the patella and none of suppurative osteomyelitis.

This paper discusses only primary suppurative osteomyelitis of the patella of hæmatogenous origin. An effort has been made to collect all the recorded cases. In looking over the literature the meagerness of some of the reports makes it difficult to determine whether the infection was of hæmatogenous origin or whether it was directly introduced through trauma.

The earliest case reported was that of M. Thirion of Namur, France, in 1829. Dr. O. B. Knode reported a case in 1860 which is the second case reported and the first from this country. Coulson, as early as 1853, reported a case of necrosis of the patella with removal, but does not state how the infection took place. The last case reported was that of E. B. Mumford, in November, 1921.

The most extensive writings on this subject are the papers of H. Walther, in 1917, who reported 2 cases and reviewed the German literature up to that date, and J. Ducuing, in 1911, who reviewed the French cases. François, in 1888, also reviewed some of the earlier French cases.

The following is an abstract of 36 cases reported in the literature up to date together with my own case.

M. Thirion. The patient, a male, age 16, in 1825 received a contusion over the upper part of the right leg resulting in rather extensive inflammation and later suppuration. The wound drained but healed in 6 months. Early in 1828 he struck his right leg against a wall. The next day the knee swelled greatly and became hot, tender, and painful. It was treated with poultices. Ulceration of the skin and discharge of pus followed. A year later M. Thirion saw the case. On examination, a probe in the sinus passed through the patella and entered the knee joint. The patient could flex the leg without pain. A crucial incision was made over the patella which was found carious and fragmentary and was removed. The articular ends of the femur and tibia were found normal. The wound was closed with adhesive plaster and healed with very little suppuration, but it was 5 months before the patient could walk with crutches. The final result was a partial ankylosis of the knee-joint.

O. B. Knode. The patient, a male, age 21, fell on frozen ground slightly bruising the left knee. He paid little attention to it but later the knee became swollen, hot, and tender. It was treated with applications until the skin over the patella sloughed. When seen by Knode, in March, 1859, the patient was pale, emaciated, and had a pulse of 120. The dead patella was found in a mass of granulation tissue which sprouted above it an inch high. The entire patella was removed exposing the articular ends of the femur and tibia, which appeared normal. The wound was cleansed, and the knee placed on pillows with the limb partly flexed. In 5 months the wound was healed and knee function was completely restored.

C. Kelly. The patient, a girl, age 7, pricked her finger with a dirty fork. A few days later she had a slight chill and the left knee became painful. The

temperature was high and she showed distinct pyæmic symptoms. Three weeks after the primary injury the knee-joint was opened and discharged a little pus. The finger was also opened and discharged freely. Six weeks later, while dressing the wound, the patella was found lying loose near the surface and it was removed. The bone was yellow in color and had a worm-eaten appearance on its lower border and posterior surface. By this time the finger was healed. She left the hospital 3 months after admission, no new bone having formed up to the date of her dismissal.

Cayley. The patient, a boy whose age is not given, without definite injury or other apparent cause had a painful swelling of the knee followed by the formation of an extracapsular abscess over the front of the knee. This was opened and a piece of dead bone removed from the patella. The joint was not affected. The leg was placed on a back splint and the wound healed well.

M. Gay. The patient, age 13, 4 months before admission had a painful, red swelling of the knee. An abscess formed over the patella and opened spontaneously. The necrotic patella was found in a bed of granulations and was removed. The wound healed rapidly.

François. Case 1. A boy, age 5, was struck in play over the knee. The pain was acute for a short time but the skin was not abraded. He continued to go to school but had pain from time to time. At the end of 2 months fever and violent pain began. An abscess formed over the front of the knee which opened spontaneously and left a sinus. An incision was made and the patella found detached from the underlying tissue. He was discharged with the leg in extension in a silicate cast. After this was removed the knee became stiff, the leg partially flexed.

François. Case 2. A male, age 23, was kicked on the knee by a horse, at the age of 5. Fifteen years later he had to quit his occupation. The knee swelled and the pus was drained away through numerous incisions. The necrosed patella was seen in the depths of the wound and was removed without opening the knee-joint. The joint was stiff at first but motility was finally established until an angle of 80 degrees of flexion could be attained.

W. A. Wright. A boy, age 7, received a blow on the left knee. The joint became swollen, red, and painful. Nine weeks after the injury, the skin over the patella opened and discharged pus, leaving a sinus. An exploring probe led to the patella. An incision was made and a sequestrum was removed from the center of the patella leaving an opening which led to the joint. The knee-joint was opened on both sides draining much serous fluid and coagulated lymph. Three months later the joint was examined under anæsthesia and many adhesions found within it. The remaining patella was firmly fixed to the femur. Some months later the knee was still much swollen and the joint but slightly movable.

T. V. Dodd. The patient, a woman, age 29, 9 months previously without an apparent cause had great pain and swelling of the knee with almost complete limitation of motion. Suppuration afterward pointed over the patella and dead bone could be felt with a probe. The whole patella was found to be necrotic and was removed, the gouge entering the knee-joint. The joint was opened and the articular surfaces found normal. The wound was closed with drainage and healed in 2 weeks. The leg was put in splints for a fortnight when gentle movements were begun. In 2 months she walked painlessly and could bend the knee to a right angle.

B. Walker. A miner was injured about the knee by a fall of coal 2 years previously. When seen he had several sinuses about the knee, one of which led to necrosed bone. The knee-joint was opened and explored, the patella found necrotic and removed. The leg was put on a back splint and the wound dressed with salicylic wool. An erysipelas developed which disappeared in a month. In another 6 weeks healing was complete but the knee-joint was stiff.

A. Shimonek. A boy, age 13, struck his knee on an iron fence causing some pain but not enough to stop his play. That night the joint became very painful, swollen, red, and immobile. Suppuration and spontaneous discharge of pus followed leaving two discharging sinuses on the outer side of the knee. The knee-joint was opened and drained much pus but healed in 2 weeks. A sinus then appeared over the center of the patella leading down to the bone. The patella was first curetted and later counter drainage was established, but the sinus persisted. The necrotic patella was then removed leaving only a cartilaginous rim at the lower border. The wound healed well and passive motion was instituted. In 6 months a new patella larger than its fellow but not quite as thick had formed. Perfect knee action resulted with only a slight limp.

F. Page. A male, age 26, with no history of injury was seen with a large collection of pus around the right knee extending up the thigh. The abscess was opened and drained but a sinus remained over the patella through which bare bone could be felt. Fifteen days later the necrotic patella was removed. The wound healed rapidly and in 15 days he walked out of the hospital without lameness. He experienced only a slight check on arising from a sitting to a standing posture.

Ollier. Case 1. Patient, age 44, at the age of 14 had a painful swelling of the knee. A sinus formed and the knee ankylosed at an obtuse angle. Twenty-five years later without known cause, the knee became inflamed, the skin over the patella ulcerated, showing the patella lying in a granulation-lined cavity. Amputation was done on account of the increasing cachexia. The patellar surface of the femur was eroded, and there was an ankylosis between the tibia and femur.

Ollier. Case 2. A boy, age 9, the next day after bathing in a creek, had a severe pain in the knee and the leg was instinctively held rigid. The pain increased and a large, fluctuating mass appeared over the patella. The skin in the popliteal space

was unchanged. A crucial incision was made, the patella found necrotic, and removed. The patella later reproduced.

Sir J. Paget. A female, age 44, without evident cause, began having pain in the front of the left knee only at night. It was very tender to the touch but only slightly swollen. In 2 months the knee was tender, swollen, and painful. A diagnosis of rheumatism was made, blisters applied, and the nocturnal pain subsided but the swelling remained. Two months later a swelling appeared over the patella which opened and discharged pus. The joint was swollen, puffy, and elastic with a little effusion into the joint. The joint was not tender to pressure or movement and there was only a slight limp. An incision was made over the drainage opening and a hole one-sixth of an inch in diameter was found passing through the bony part of the patella but not entering the knee-joint. The external opening was widened, the cavity packed, and slow healing with perfect knee function followed.

Lannelongue. The patient, age 7, fell on the knee a year previously. He soon had a high fever and the knee became swollen. Suppuration followed, the pus discharging from a sinus over the patella. The wound was enlarged, and the patella found necrosed.

Lannelongue mentions incidentally that he had a case of osteomyelitis of the tibia followed by involvement of the opposite patella.

Nasse mentions two cases seen in von Bergman's clinic, but says that only in one after complete necrosis of the patella it was reproduced and in the other regeneration was not complete but perfect knee function followed.

Duvergey. A man, age 60, suffered a fracture of the hip and gave the following history. At the age of 6 he fell on his left knee. Some days later the knee-swelled and he had high fever. An abscess opened near the head of the fibula and some pieces of dead bone escaped. The wound healed in a year and a half with some limitation of motion of the knee-joint. The patient died a week after his last injury from intestinal obstruction. Autopsy showed the left patella much enlarged, weighing 165 grams while the right weighed 45 grams. The left was irregular in outline but in general conformed to the normal shape.

Berger. The patient, age 50, at the age of 9 got a pain along the inner border of the patella. Nélaton diagnosed tubercle and excised an area of soft tissue but without result. Labbé incised the painful area and used the cautery without results. The patellar area was very sensitive, preventing flexion of the leg and the muscles about the knee began to atrophy. Amputation was considered for relief of pain. The X-ray showed the inner border of the patella roughened and a diagnosis of osteitis was made. The patella was found friable and was excised. A post-operative diagnosis of non-tuberculous osteitis was made.

Trendel. A male, age 29, struck his knee against the corner of a table producing no outward signs of injury. He went on working but next day went to bed with much pain in the knee, and fever. The pain was severe, the fever high and the knee, leg, and thigh were greatly swollen. The knee-joint could be only slightly moved. Incisions were made about the knee which discharged pus and later two sequestra. Sinuses persisted. He was seen by Trendel 5 months after the injury. The leg was flexed at 135 degrees and could be moved passively only 20 degrees. The sinuses were dissected out and a sequestrum removed from the outer edge of the patella. The wound healed in a month but there was no change in the condition of the knee-joint.

W. Roepke. Case 1. A girl, 8½ years of age, fell on the left knee without causing skin trauma. Swelling of the knee followed and 6 weeks later an incision was made along the outer edge of the patella and pus evacuated. The wound did not heal, the fever ran high, fluctuation appeared in the knee-joint, and abscesses formed in the popliteal space and around the head of the tibia. Several sinuses opened around the knee. Eight months after the injury a large loose sequestrum was removed from the center of the patella, and much pus was drained from the knee-joint. Death from meningitis followed.

Roepke. Case 2. A male, age 72, a few days after the amputation of five dry gangrenous frozen toes, noticed a pain along the upper edge of the patella of the opposite leg. A month later this area became swollen and very painful but he had no fever. Eighteen days later the pain was worse and there was effusion into the knee but he had no fever. An incision was made and two small cartilaginous sequestra were removed from the outer side of the patella. By the end of 5 months healing was complete with perfect knee function.

Creite. A male, age 18, 8 days after the onset of an influenza had a painful swelling of the knee and effusion into the knee-joint. The temperature was 39.5 to 40 degrees. The swelling extended up the thigh and the knee was held in partial flexion. A diagnosis of osteomyelitis of the lower end of the femur was made but the inflammatory symptoms subsided and the patient was dismissed. Three months later multiple abscesses pointed around the patella and a large abscess extending up the thigh was opened and drained. Probes introduced did not lead to the femur but to the inner surface of the patella. The knee-joint was opened, it being necessary to chisel the patella from the femur. A sequestrum was removed from the patella. The space between the tibia and femur was filled with connective tissue. The wound healed with little drainage and the patient was sent home in a plaster cast 7 weeks later.

Mueller. Case 1. A boy, age 12, became suddenly ill with a severe pain in the left knee. The next day he had a chill followed by fever and much pain and swelling in the knee. An abscess opened spontaneously but the knee remained painful and the patient did not recover. The knee became swollen, red, and œdematous, and there was definite joint fluctuation.

The fever was 38 to 38.5. A sinus on the anterior side led down to the patella. An incision was made over the patella and a sequestrum was removed. A sinus communicated with the knee-joint, which was filled with pus. The joint was drained in four places. In 6 weeks healing was complete, and the patient had a movable knee-joint.

Mueller. Case 2. A boy, age 12, 4 weeks after the beginning of an osteomyelitis of the calcaneus, had a painful swelling of the knee of the opposite leg. The knee-joint was aspirated and serous fluid containing fibrin flakes was removed. The joint effusion quickly returned and there was much swelling in the patellar region. Two weeks later a sequestrum the size of half an almond was removed from the patella. The infected area communicated with the knee-joint which was drained. In 4 weeks healing was complete with complete restoration of knee-joint function.

Desgouttes and Cotte. A boy, age 12, 2 years previously had a pain in the knee and lower end of the femur. An abscess opened spontaneously, sequestra were discharged, and the wound healed. The knee remained much swollen. The patella was found to be much increased in size. A diagnosis of osteomyelitis of the patella with spontaneous cure was made.

Ludloff. A girl, age 15, with an otitis media following scarlet fever, was stricken with a sudden pain in the right knee. The pain increased without any signs of knee-joint inflammation. It was treated variously without results, and finally put up in spints. When seen by Ludloff, the whole extremity was atrophied, the knee-joint was barely swollen, the knee was almost fixed, and there was loud crepitation on passive movement. Lateral and anteroposterior X-rays showed nothing, but some made at various angles showed a sequestrum in the posterior part of the patella. The joint was opened and found normal, the sequestrum was removed, and the joint closed. The leg was put on a splint with the knee at an angle of 140 degrees. Passive and active motions were instituted and massage given, with the result that the knee action became normal and the atrophy almost completely disappeared.

J. Ducuing. In Ducuing's case a sequestrum the size of an almond was removed from the patella. The wound healed rapidly with perfect restoration of knee-joint function.

F. Partsch. A boy, age 12, 27 days after the onset of a carbuncle of the chin, developed a painful swelling of the right knee. There was redness and fluctuation over the patella. A diagnosis of prepatellar bursitis was made and the bursa was incised 2 weeks later. The wound continued to drain pus and after 2 weeks he could bend the knee only 45 degrees. A probe in the wound touched the bare patella. The X-ray showed the patella in two pieces. This was removed and was found to be necrotic. Complete restoration of joint function followed. Staphylococcus pyogenes aureus was isolated from both the carbuncle and the necrotic patella.

A. B. Elliott. A boy, age 9, had been kneeling in snow slush and the skin for a radius of 3 inches around the patella sloughed, discharging pus and later the anterior necrotic half of the patella. No symptoms were mentioned.

E. M. Sympson. A male, age 73, bruised his right patella by falling on it. Several months later the soft tissues gradually ulcerated and exposed necrotic bone. The anterior surface of the patella was removed, a piece about the thickness of a five shilling piece being separated from the posterior portion by a layer of granulations. Healing was complete in 4 months. The writer says that there was a vertical splitting and subsequent death of the anterior portion.

H. Walther. Case 1. A boy, age 6, struck his knee on a bed. The knee swelled anteriorly with obliteration of the patellar outline. The temperature went to 38 degrees, fluctuation appeared over the patella and it was very sensitive to pressure. A diagnosis of patellar bursitis with effusion into the knee-joint was made. The bursa was found filled with serous fluid and a sinus led down to the bare surface of the patella which was movable. A sequestrum was removed from the anterior surface of the patella and the wound drained. Staphylococcus was cultured from the bone. Two weeks later a suppurative arthritis of the knee-joint made its appearance. The joint was opened and drained. A month later active and passive motion was begun. By 9 months after the original operation, he had active painless movement of the knee from 10 to 168 degrees.

Case 2. A boy, age 11, without apparent cause, had pain, swelling, and redness in the right knee. After poulticing an incision was made over the patella, evacuating pus. The wound healed in 2 months, leaving sinuses. The knee remained swollen and red. The X-ray showed a sequestrum occupying almost the whole patella. An incision opened an abscess in the upper and outer quadrant of the patella and three sequestra were removed. Staphylococci and streptococci were found in the dead bone. In 4 months he had active, painless, extension of the leg through 172 degrees.

E. B. Mumford. A boy, age 5, had a slight injury of the right knee but kept on playing. The next day the knee was swollen, red, and tender over the anterior aspect. Pain on the slightest motion was intense. This was the condition when it was seen by Mumford 2 weeks later except that the pain and swelling were worse and the temperature was elevated. Swelling extended over the front of the thigh with fluctuation over the patellar tendon. X-ray of the femur and patella was negative and aspiration of the knee-joint showed a little bloody fluid free from pus. An incision on the outer side of the patellar ligament evacuated 6 ounces of thick pus. Ten days later dead bone could be felt in the wound. The X-ray at this time showed the bony change. Three weeks after the first operation a large sequestrum was removed from the patella. He was allowed 20 degrees motion from the start and sent home with

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1. X-ray taken 5 weeks after operation showing practically a total absence of the patella.

Fig. 2. X-ray taken 3 months after leaving the hospital showing beginning regeneration of the patella.

Fig. 3. X-ray taken 15 months after operation showing a large regenerated patella. The tibia is shown in complete extension.

lateral irons to be taken off daily for exercise. Six months later he had flexion of 90 and extension of 180 degrees. The X-ray showed the patella to be a thin plate of bone.

Chesky. A boy, age 9, 6 days before entering the hospital, struck his left knee on a tree stump while riding a bicycle. It produced no visible injury and he gave it no attention. The next morning there was some swelling and pain in the knee. The temperature was 101. The case was treated by his physician as a beginning acute rheumatism. The pain and swelling increased and the temperature went to 102 and 103 daily. He entered the hospital 5 days after the onset. The joint was swollen, hot, red, and very tender. There was an effusion into the knee-joint which was held partially flexed. There was much pain on attempts at passive motion. A diagnosis of suppurative arthritis was made and the joint was opened by Dr. A. E. Hertzler. A yellow serous fluid was evacuated which showed no pus. Drains were inserted and the leg placed on a back splint. Five days later a fluctuating mass appeared over the patella. An incision over this evacuated a considerable amount of thick, yellow pus. The patella was found necrotic and lying loose in the bottom of the abscess cavity, and was removed. The wound was drained. The temperature dropped to normal in a few days, the pain disappeared, and the patient could bend the knee without pain. The first diagnosis was obviously incorrect but fortunately the wound made at the first operation healed without the knee-joint becoming infected before the correct diagnosis was made and the second operation done. Staphylococcus aureus was cultured from the necrotic patella. Five weeks after the second operation the patient was dismissed from the hospital with the wounds practically healed. He walked without pain with some support from a crutch.

An X-ray taken at this time showed only two small indistinct shadows in the patellar region (Fig. 1). The articular surfaces of the tibia and femur appeared normal. Three months after operation he could walk unsupported without pain or limp and could fully extend the leg and flex it through an angle of 135 degrees. An X-ray taken at this time shows a beginning regeneration of the patella (Fig. 2). Fifteen months after operation knee-joint function was perfect and he could walk and run without pain or limp. Figures 1, 2, and 3 show complete extension of the leg and Figure 4 shows complete flexion. He had at this time what appeared to be a completely regenerated patella about one-third larger than the normal right patella but conforming to it in shape (Fig. 3). The X-ray does not show, however, as much bone formation as the examination would lead one to believe.

AGE

Among the 35 cases reported, none occurred before the age of 5 years, 22 from 5 to 15, 6 from 15 to 30 and 4 from 30 to 72. In three of the cases the age was not given. About 65 per cent of the cases, therefore, fall between the ages of 5 and 15. If we throw out some of the cases where the hæmatogenous nature of the

infection was frankly doubtful, and all of these patients were over 15, and Roepke's case, aged 72, which he thinks was infected as a child on account of the cartilaginous nature of the sequestra, together with François' Case 2, the percentage between 5 and 15 is still higher.

Roepke, who worked out the patellar circulation at various ages by injecting the vessels with an emulsion of mercury and taking X-ray plates, showed that before the age of 4 there was practically no circulation. From 4 to 5 ossification began, and the vessels began to appear in and around the ossification center. This circulation rapidly increases as ossification proceeds, reaching its maximum at about the age of 12. At 16 ossification is complete with relatively less blood supply than at 12, and at 30 the blood supply is less than at 16. The vessels come from a plexus over the prepatellar ligament, 5 or 6 small arteries winding through this ligament and entering the center of ossification at the outer border of which they ramify and form fine loops, growing toward the outer edge and posterior surface as ossification proceeds. From an anatomical standpoint, therefore, patellar osteitis of hæmatogenous origin should not be found under 4 or 5 and should become rarer after 16. This conforms very well with the figures given above.

Fig. 4. Photograph taken 15 months after operation showing complete flexion of the leg.

OCCURRENCE

Patellar osteitis is of very rare occurrence. There are several reasons given for this. Some attribute it to the poverty of vascularization, arguing that with a meager circulation there would be much less chance for infective emboli to lodge. Ducuing thinks that, according to Roepke's work, the patella is rather richly vascularized between the ages of 5 and 12 and that the short duration of the vascularization, rather than the poverty of it, is what accounts for the rarity of patellar osteomyelitis. He also says that the density of the spongy part of the patella is 1.30 and that the density of spongy bone in which infective processes especially fix themselves is about 1.15, or according to François, 1.05.

Roepke has shown that the patellar circulation is somewhat like a small shunt on a larger system. The few small vessels that do enter break up into capillaries in a very short distance. The circulation would then be necessarily slow. Emboli in the vessels from which the patellar vessels arise would be more likely to be carried on in the main channel than to be diverted by the slower moving shunt stream.

SEX

Among the cases reported there are 25 males, 5 females and in 5 the sex is not given. This proportion of 5 to 1 is about in accord with the figures of H. Walther and others. It is probably due to the fact that the male being the more active physically is the more likely to receive an injury.

CAUSE

Fourteen cases gave a history of injury, usually slight, about the knee. In 13 cases nothing was said of injury. One followed a finger abscess caused by the prick of a dirty fork, one after bathing in cold creek water, one complicating influenza, one following an

operation for osteomyelitis of the os calcis, one after otitis media, one after a carbuncle of the chin, one after kneeling in snow slush and one following the amputation of frozen toes. The last, Roepke's case, a man aged 72, he thinks was infected in childhood and the infection lighted up by the later trouble and decreased resistance of the patient. Lannelongue mentions a case of osteomyelitis of the tibia followed by an infection of the opposite patella.

Only in four cases was the infective organism given, three showing a staphylococcus and one a mixed staphylococcus and streptococcus. Creite took it for granted that the influenza bacillus was responsible for his case which complicated an influenza. Knowing the association of the streptococus and other pyogenic organisms with the influenza bacillus, he was probably assuming more than was justified.

It is probable, therefore, that trauma, even slight, is a predisposing cause, that it may start in the course of other infections and that the staphylococcus and streptococcus are usually the infective organisms.

PATHOLOGY

The infection starts in the center of ossification, the vessels are thrombosed and the bone already formed dies. The pus points anteriorly first, as posteriorly in the young there is a thick layer of cartilage which forms a rather effectual barrier to knee-joint involvement. This cartilage becomes thinner as ossification nears completeness until in the adult it is only 2.5 millimeters in thickness. In adults then the knee-joint is involved much more readily. The prepatellar bursa is usually involved and the pus discharges at a point directly over the patella or sinuses may open anywhere around the outer edge of the patella. These remain open or alternately heal and open until the sequestrum is removed. Duvergey and Desgouttes report cases in which healing was spontaneous. The pus may burrow upward in the fascial layers of the thigh. There is practically always an effusion into the knee-joint and an inflammatory reaction in the soft tissues of the anterior and lateral aspects of the knee. The popliteal space shows little or no reaction. Untreated cases show a sequestrum, which may comprise the whole bony portion of the patella. This is often found loose in a bed of granulation tissue. In the late untreated cases, the posterior cartilage and synovia may be broken down and the knee-joint infected.

There is a more chronic type in which a low-grade infection may produce a sequestrum and no abscess form. The infection may remain dormant for years until some other condition excites it to activity or a greatly lowered resistance allows it to form an abscess and go on to sinus formation. This type is illustrated by the cases of Roepke's Case 2 and François' Case 2.

SYMPTOMS AND PHYSICAL FINDINGS

The symptoms are pain, which may at first be mild, later becoming of the severe, lancinating type usually referred to the knee, elevation of temperature, rapid pulse, swelling of the anterior and lateral aspects of the knee, tenderness to pressure over the knee-joint but more acute directly over the patella. There is very little or no swelling in the popliteal space and the skin there is often not discolored. There is an effusion into the knee-joint. The leg is usually held fully extended at first but later when the joint effusion becomes marked it is partly flexed. There is marked limitation of motion. Gentle active or even passive motion elicit much pain. Finally the abscess points externally and one or more sinuses form.

The X-ray shows nothing early but when the sequestrum forms this shows in the roentgenograms. This may not show in the antero-posterior or lateral views, as in Walther's case, which he said showed only in plates which were made at various angles.

Ducuing makes the following classification of types: The acute, which is the most frequent, in which the onset is severe and rapid, the constitutional symptoms being marked and in which the sequestrum is formed and the abscess points in from 1 to 3 weeks; the chronic, so called even in the beginning, when it does not present the severe acute phenomena but in which the end-result is the same. Under this form he also speaks of a neurological type but does not explain it. The third is

the prolonged or recurrent type in which the sequestrum forms, the general toxic symptoms are not marked or of long duration and the abscess may not point for years afterward. This type is illustrated by Roepke's Case 2 and François' Case 2.

COMPLICATIONS

Little is said about complications. They are mostly local. Invasion of the knee-joint with suppuration, infection of the prepatellar bursa and abscess formation in the region of the knee are the principal ones. One case was complicated by erysipelas and one died of meningitis.

DIAGNOSIS

In no case was a diagnosis made before the sequestrum had formed and in most of them discharging sinuses were present. The most frequent error is the diagnosing of a suppurative arthritis of the knee-joint. It may also be confused with osteomyelitis of the lower end of the femur and with patellar bursitis.

No case has been reported before the age of 5 and they become less frequent after 15. According to Ducuing, the temperature rarely goes over 102.2°, violent chills and delirium do not occur and only the anterior surface and sometimes the lateral aspect of the knee are deformed, the posterior retaining its normal appearance. The extremity is held straight until effusion into the joint occurs and the greatest pain and tenderness is over the patella and on a level with it. The effusion into the joint is usually not enough to lift the patella from the condyles and it often becomes absorbed when the patient is put to bed. Aspiration of the joint shows a clear fluid negative to bacterial culture. Nasse says that the condition is often recognized by abscess in the bursa and may be diagnosed when prepatellar bursa phlegmon is present. If the sequestrum has formed, the X-ray will make the diagnosis and if sinuses are present, the probe will lead down to the bare sequestrum.

In suppurative arthritis the temperature is much higher, the systemic reaction of chills and delirium is frequent, the entire knee is deformed, the articular depression on both sides and back disappearing. The knee is partly flexed in marked distinction to early patellar osteitis. Pressure on the bottom of the foot causes violent pain which it does not in patellar osteitis. The X-ray shows the patella lifted from the condyles. Aspiration of the joint shows pus and organisms.

Osteomyelitis of the lower end of the femur occurs at the lower end of the diaphysis near the epiphyseal line. The greatest pain and tenderness will be found over the epiphysis. It may occur even in infancy. The constitutional symptoms are marked. The leucocytosis runs from 25,000 to 30,000. Swelling and redness of the soft tissues over the bone soon appear. The knee is held partly flexed.

Prepatellar bursitis is most apt to occur in adults and in those whose occupation subjects the bursa to trauma. The swelling outlines the bursa and there is little constitutional reaction.

TREATMENT

If the diagnosis is made early, incision down to the patella should be made and drainage instituted. If a sequestrum has formed, it should be completely removed, care being taken to preserve the periosteum and posterior cartilage. If the joint is already involved this should be drained. A back splint should be applied. The quadriceps tendon should be kept from retraction. Passive motion should be instituted early and muscular atrophy prevented by massage and exercise. Effusion into the joint always becomes absorbed if infection is not present. Hot applications or baking the joint may, in cases where it has been involved, help secure a greater range of motion. If ankylosis is inevitable the proper position of the leg should be maintained.

PROGNOSIS

There is practically no mortality. One case died of meningitis following operation. If operated upon before the knee-joint is involved and proper after-treatment given, the functional prognosis is very good. Of the 35 cases reported, 13 showed complete restoration of function, 9 showed a partial disability ranging from a slight motility to almost perfect knee action, 4 showed a complete ankylosis, nothing was said about 8 of the cases and

one died. In view of the fact that so many of these were old, neglected cases, one would be fairly safe in assuming that with even a fairly early diagnosis, the functional result would be good in almost every case. Even after joint infection, if drainage is instituted and proper after-treatment given, some have had only slight limitation of motion. Neglected cases where the joint is long involved usually have ankylosis. The patella frequently regenerated, especially in children where the periosteum was preserved.

CONCLUSIONS

Patellar osteitis of hæmatogenous origin is rare compared to osteomyelitis elsewhere. It has never been seen before the age of 5 and is the most frequent between 5 and 15.

Ossification of the patella starts at the age of 4 to 5 and is completed by 16. The blood supply is practically nil before 5, richest from 5 to 15 and diminishes after that age.

There is a frequent history of slight trauma preceding the onset of patellar osteomyelitis.

Abscesses practically always point anteriorly and the knee-joint is involved only in late, neglected cases.

The prognosis as to function is good if operated on before the knee-joint is involved.

The patella is frequently reproduced in children even after complete removal, if the periosteum is preserved.

BIBLIOGRAPHY

THIRION, M. Successful extirpation of the right patella for caries. (Abstr.) Lancet, Lond., 1829, ii, 309.

COULSON. Necrosis of patella; removal of dead bone; recovery. Lancet, Lond., 1853, i, 560.

KNODE, O. B. A case of removal of the patella of the left knee with recovery and excellent use of the joint. N. American M. Chir. Rev., 1860, iv, 486–488.

KELLY, C. Necrosis of the patella. Tr. Path. Soc., Lond., 1871, xxii, 198–199.

CAYLEY. Acute necrosis of the patella. Brit. M. J., 1877, i, 710.

GAY, M. Removal of necrosed patella. Lancet, Lond., 1876, ii, 322–323.

FRANÇOIS, P. Des ostéites primitives et isolées de la rotule. These de doct., Lyon, 1888, No. 451.

WRIGHT, G. A. Cases of necrosis of the patella leading to disease of the knee joint. Lancet, Lond., 1883, i, 589.

DODD, T. A. A case of excision of the patella; recovery with movable joint. Lancet, Lond., 1884, i, 523.

WALKER, B. Excision of patella for necrosis. Brit. M. J., 1884, ii, 1194.

MUELLER. Der acute Osteomyelitis des Gelenkgebiete. Deutsche Ztschr. f. Chir., 1885, xxi, 473–474.

SHIMONEK, A. Excision of patella with reproduction. Tr. Minnesota M. Soc., 1885, 55–57.

BRADFORD. Caries with perforation of the patella. Boston M. & S. J., 1882, ii, 251.

PAGE, F. Acute necrosis of patella; removal of patella; recovery with useful joint. Lancet, Lond., 1880, i, 529.

OLLIER. Rotule suppurie; nécrose de la rotule; élimination totale de cet os; reproduction intégrale de la rotule; conservation des movements du genou. Traite des resections, vol. iii, 339.

Idem. Osteo-arthrite chronique du genou; ankylose angulaire; nécrose de la rotule; amputation. Traite des regeneration des os, 1887.

PAGET, SIR J. Abscess in the patella. In His Studies of Old Case Books. London: 1891, 146–148.

LANNELONGUE. Ostéomyélite traumatique de la rotule. Ann. d'orthop. et de chir. prat., Par., 1895, viii, 296–300.

NASSE, D. H. K. Chirurgische Krankheiten der unteren Extremitaeten. Stuttgart: F. Erike, 1897.

DUVERGEY. Ostéomyélite ancienne de la rotule. Bull. Soc. anat. et physiol., Bordeau, 1900, xxi, 42–45.

BERGER, P. Extirpation de la rotule pour une ostéite chronique d'emblée de cet os, suivie de la conservation des mouvements du genou et de la restauration des fonctions du triceps fémoral. Bull. Acad. de méd. Par., 1901, xlv, 69–76.

TRENDEL. Beitrag zur Kenntniss der akuten infektiosen Osteomyelitis und ihrer Folgeerscheinungen. Beitr. z. klin. Chir., Tuebing, 1903–4, xli, 607–675.

ROEPKE, W. Zur Kenntniss des Tuberculose und Osteomyelitis der Patella. Arch. f. klin. Chir., 1904, xliii, 492–506.

CREITE. Beitrag zur Pathologie der Kniescheibe. Deutsche Ztschr. f. Chir., Leipzig, 1906, lxxxiii, 179–188.

DESGOUTTES, L., and COTTE, G. Sur un cas d'ostéomyélite de la rotule. Rev. d'orthop., Par., 1908, ix, 157–160.

LUDLOFF. Zur Pathologie des Kniegelenkes. Verhandl. d. Deutsch. Gesellsch. f. Chir., 1910, 223.

Idem. Die Diagnostik der Kniegelenkaffectionen. Jahresk. f. aerztl. Fortbild., Muenchen, 1912, iv, 15–50.

DUCUING, J. Diagnostic pronostic et traitement de l'ostéomyélite primitive de la rotule. Prov. méd., Par., 1911, xxii, 98–105.

Idem. Ostéomyélite primitive de la rotule. Arch. méd. de Toulouse, 1911, xviii, 169, 189, 209, 229.

PARTSCH, F. Ostéomyelitis der Patella. Deutsche med. Wchnschr., 1912, xxxviii, 1460.

ELLIOTT, A. B. Necrosis of half a patella. Lancet, Lond., 1915, ii, 944.

SYMPSON, E. M. Necrosis of half a patella. Lancet, Lond., 1915, ii, 339.

WALTHER, H. Beitrag zur eitrigen Osteomyelitis der Patella. Arch. f. klin. Chir., Berl., 1917, cviii, 371–386.

MUMFORD, E. B. Primary osteomyelitis of the patella; case report. J. Orthop. Surg., 1921, iii, 583–586.

TWO EMBRYOLOGICALLY IMPORTANT SPECIMENS OF TUBAL TWINS

Including Critical Summaries of All Known Cases[1]

By LESLIE B. AREY, Chicago
Anatomical Laboratory, Northwestern University Medical School

INTRODUCTORY

THE uterine tube is occasionally the seat of plural pregnancies. In general, these are separable into three topographical types: (1) all the fœtus may be in one tube (unilateral tubal twin pregnancy); (2) the fœtus may be divided between both tubes (bilateral tubal twin pregnancy); (3) the fœtus may be divided between one or both tubes and the uterus (tubo-uterine pregnancy).

The commonest plural pregnancy that involves the uterine tubes is the combined tubo-uterine type. According to Cameron (1906), Vilsin recorded 65 cases (in 25 of which the tubal fœtus reached maturity!). In 1905 Weibel had collected over 119 cases although it is probable that some of these are merely presumptive and not all are twins. Plural gestation in the same tube is next common. Pulcher (1905) found 18 examples; Costa, in 1907, listed 11 cases which he considered certain and added 15 presumptive cases; McCalla (1909) cites 25 positive cases; Pool and Robbins (1910) give 26 positive cases and reject 18; Hardouin (1919) enumerates 37 as positive and eliminates 13 as spurious. Rarest are bilateral tubal pregnancies. Although McCalla (1909) collected 37 cases and McDonald and Krieger (1913) list 25 proved and 27 probable specimens, less than a dozen of these actually are twins.

NEW CASES OF TUBAL TWINS

Two new specimens of unilateral tubal twins have come under my observation. Each is unique of its kind and both present features of great embryological significance.

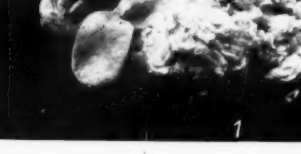
The first new case[2] belongs in the collection of the Carnegie Institution, where it is listed as No. 1126.

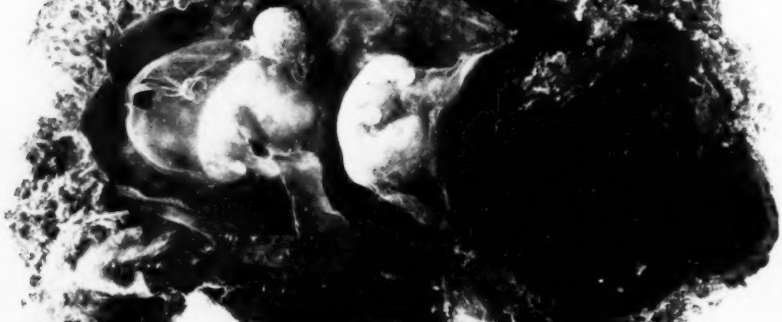
The patient was a married Italian woman, about 30 years old. When medical aid was summoned she had been flowing several days but had considered it her regular period when it began. At operation the right ovary and tube were found normal. The pregnant but unruptured left tube was removed, opened, and its contents sent to the Department of Embryology of the Carnegie Institution. The specimen, when received, consisted of an opened single chorionic sac (22 by 16 by 16 millimeters), attached to which were twin embryos, each 12.3 millimeters long (Fig. 1). This size represents an age of slightly over 6 weeks. The embryos are entirely separate, but apparently enveloped in a single amnion. There is a common yolk sac (Fig. 1) from which two yolk stalks arise near together (Figs. 2 and 3) and enter their respective umbilical cords. The whole specimen is somewhat shrunken, one of the twins more than the other; except for this they appear normal.

The second new specimen came from a young colored woman, 7 weeks past her mensis, who had reached the hospital with symptoms of grave internal hæmorrhage. Her vitality was so low that immediate and rapid interference became necessary. One tube was swollen and ruptured; it was removed. When the undisturbed specimen came into my possession it had been preserved in formalin, and by its own weight the tube had flattened. The broader end, at the point of rupture, was hard with caked clots. In one part of the tube the wall was thin and this was removed to expose the interior (Fig. 4). The single chorionic cavity thus opened measured about 28 by 48 millimeters in its flattened condition. Within were perfectly formed twin embryos, the one at the left in Figure 4 measuring 11.5 millimeters, the one at the right 12 millimeters. Each possessed its own amnion; contained in that part of the amnion of the embryo at the right which was close to the rupture, there is coagulated blood. The embryos have separate umbilical cords inserted in the chorionic wall at a quadrant's distance; the cord of the embryo at the right may be seen in the photograph coursing horizontally to the wall; that of the other embryo passes upward to a flap which formed part of the roof of the sac. Adherent to the amnion of one embryo (at the left in Fig. 4) is a yolk sac, 4.5 by 6.0 millimeters in size; its stalk which joined the umbilical cord has been cut in order to remove the roof of the sac; the remaining stump may be seen in the photograph. The other embryo has no yolk sac. To make certain of this, both umbilical cords were sectioned serially throughout their lengths. That of the embryo on the left

[2]Acknowledgement is due the director, Dr. George L. Streeter, for permission to describe this specimen.

[1]Contribution No. 89.





(Legend on opposite page.)

gave the appearance typical at this age (Fig. 5); the yolk stalk with its vitelline vessels lies in a cœlomic extension; the level of the section photographed is too far distad to include the allantois. The cord of the embryo at the right is without microscopic trace of yolk-sac or -stalk although the remaining structures are normal (Fig. 6).

Both specimens present highly significant features. The first demonstrates for the first time the actual origin of homologous human twins from the same ovum. There has been no real doubt of this, for many facts point incontestably to such a conclusion; as illustrative evidence may be cited their morphological duplicity, their occasional conjoining as "double monsters," and the common chorion. Direct corroboration is furnished by the regular development of single-ovum quadruplets in one mammal, the Texas armadillo, as well as by experiments and observations on the lower vertebrates and invertebrates.

Such single-ovum twins do not arise by the separation of early cleavage cells, as too often has been assumed; on the contrary, the common chorion, which all twins of this sort possess, proves at once that separation must be subsequent to the period when the cleavage mass is differentiated into an inner cell mass and an outer shell of trophectoderm. There exists considerable evidence which supports the belief that the twinning impulse occurs relatively late, at about the moment of gastrulation, which in mammals corresponds to the time of the formation of the primitive streak; the process, then, is simply one of double gastrulation.

The second specimen bespeaks its single-ovum origin about as strongly, for only one yolk sac and stalk are present. Two possible interpretations suggest themselves. It is conceivable that originally there were paired stalks, as in the first specimen described, one of which precociously lost its yolk-sac connection, whereupon it disappeared without trace. On the contrary, the early division of the embryonic mass may have been unequal so that one member received essentially all the material of the future yolk sac, leaving the other from the first with a mere rudimentary "sac"; of special weight in favor of this view is the absence of a second sac, and the missing yolk stalk which persists normally beyond the fourth month even though its union with the gut is usually relinquished in embryos slightly younger than this 6 weeks' specimen. Personally, the writer favors such an early primary separation, rather than a late secondary one with the coincidence of precocious disjunction of the stalk and its simultaneously prompt disappearance. But whichever interpretation is correct, the single-ovum origin is equally well supported.

The primary absence of a distinct yolk sac in one embryo, which is otherwise normal in every way, would further indicate that this organ is not physiologically essential to the growth of an embryo or to the continued differentiation of its parts; indeed, the embryo in question is slightly larger than its twin, whereas both correspond closely in size to the norm for that menstrual age. To be sure, the gut and allantois form from yolk-sac entoderm, yet it is entirely possible that this may occur without a significant sac, as such, ever developing.

The embryo without a yolk sac is of additional interest in relation to the ingrowth doctrine of vasculogenesis which holds that blood vessels, first arising on the yolk sac and elsewhere, invade the embryo as continuous growths. In so far as such evidence is trustworthy, it supports rather the local origin view, now generally acknowledged. That tiny vascular anlages of yolk-sac ancestry actually existed and at an earlier moment helped form primitive vessels by extension into the embryo, is, of course, conceivable; also the theoretical possibility of vascular ingrowths from the early anlages in the body

Fig. 1. Photograph of 12. 3 millimeter human tubal twin embryos attached to a common yolk sac. ×2.3.

Figs. 2 and 3. Additional photographs of the common yolk sac shown in Figure 1. The origin of the separate yolk stalks is apparent. ×2.3.

Fig. 4. Photograph of a pregnant human uterine tube. Part of the wall has been removed to show the twin embryos in place. The single yolk sac belongs to the 11.5 millimeter embryo at the left. The 12.0 millimeter embryo at the right lacks both yolk sac and stalk. ×1.7.

Fig. 5. Photomicrograph of a section through the umbilical cord of the embryo at the left in Figure 4. The yolk stalk lies in a cœlomic extension. The level is too far distad to include the allantois. ×24.

Fig. 6. Photomicrograph of a section through the umbilical cord of the embryo at the right in Figure 4. There is no trace of a yolk stalk. The delicate tube below is the allantois. ×24.

stalk are not excluded because of the characteristic and necessary nutritive relations of the mammalian ovum. Fortunately the fundamental truth of the local origin doctrine rests on observations more rigorously controlled than this natural experiment, which, however, was apparently performed as perfectly as ever may be expected in a higher mammal.

In general the yolk sac of man and the higher mammals appears to be functionally an unnecessary vestige. In the earliest human embryos known, when it might be of real use, it is a simple entodermal sac containing masses of coagulum; growth to a conspicuous size is attained relatively late, long after adequate nutritional relations with the mother have been established.

THE COMPLETE DATA OF TUBAL TWIN PREGNANCY

If the literature of tubal twins be examined it becomes evident that a complete or sufficient presentation of previously recorded cases has never been made. Furthermore, it appears from the perpetuation of inaccuracies and the duplication of accounts that there has been too little recourse to the original literature. For the purpose, therefore, of establishing an available and accurate record I have prepared critical summaries of all existing cases. In each instance the original publication has been examined (the literature covering communications in six languages), and the concise abstracts submitted contain all the significant anatomical information to be had. Omissions, therefore, signify defective original records.

Some old cases, inadequately described, and most doubtless successive pregnancies, are cited in the works of Boehmer (1752), Parry (1876), Schroeder (1888), von Schrenk (1893), Martin (1895), Webster (1896), and v.Winckel (1903–1907). These are omitted from the present enumeration.

The records are divisible into four groups. Thirty-eight cases (excluding the two new specimens) are positive or authentic; eight are probable or presumptive; four are possible but doubtful.[1]

[1]A suspected case of tubal twin pregnancy reported by Lewis (1921) proved later to be single. (Personal communication from Dr. Lewis.)

I. POSITIVE CASES

Albertin, 1903. A tumor the size of a fist was found in the thickened wall of the left tube, close to the uterus. Within a single chorionic sac were twin fœtus of about 3 months, each with its cord. *Remarks.* The illustration shows twins of at least 3 months, instead of 2 as estimated by the author. The history indicates their arrest must have occurred nearly a year before the operation.

Amann, 1908. Twins of about 12 weeks contained within separate sacs. *Remarks.* The entire report is in less than two lines yet it cannot be excluded from the positive cases. Pool and Robbins, 1910, and Hardouin, 1919, state that there were separate amnia; however, the phrase in question is "in getrennten Eihoehlen" which appears to refer to distinct chorionic sacs.

Andrews, 1909. A common chorionic sac comprises the ruptured right tube and broad ligament. Apparently a common amnion bulged though the posterior wall of the sac. Within were living male fœtus, of about 14 weeks, attached to a single placenta.

Baldwin, 1913. Two embryos were found in the left and one in the leaking right tube. All three were of the same size and age, "about as large as peas." *Remarks.* Neither patient nor physician suspected pregnancy. One normal menstrual period occurred after pregnancy had begun. This is proved by the size of the embryos which indicates a minimum age of 5 weeks. There is one other positive case of bilateral triplets (Launay and Sequinot, 1911).

Barbat, 1899. The ovarian end of the right tube is a single gestation sac, which had ruptured, expelling twin fœtus, 2½ months old. These had possessed a single amnion and were connected by individual cords to the placenta within the tube.

Basham, 1909. A common chorionic sac in the ruptured left tube. Twin embryos, with individual cords, attach to a common placenta. *Remarks.* From the indistinct photograph the age of the embryos appears to be about 2 months.

Bertino, 1911, 1912. The right tube contains two swellings. One is a hæmatocele, the other a chorionic sac larger than an apple. It shows two operative tears. Within a common amnion are twin male fœtus about 3½ months old, one of which was seen to move. *Remarks.* The description does not make clear whether the tube was ruptured. The photograph (cf. also Bertino, 1912) apparently shows a ruptured point near the hæmatocele.

Braham, 1914. Twin fœtus of about 18 centimeters (5½ months?) were attached by separate cords to a "fused" placenta in a single, ruptured chorionic vesicle. *Remarks.* The author believes one fœtus had been expelled prior to operation.

Brodier, 1896. The ruptured chorionic sac at the ovarian end of the left tube was filled with clots and placental tissue; among these were identical fœtus each about 7½ centimeters long (10 weeks?). *Remarks.* This case was also recorded by Le Dentu, 1896, a subordinate at the operation. The two

accounts have previously been listed as separate cases. Le Dentu gives the embryo's age as 7 to 8 weeks, obviously one of these authors is in error.

Cameron, 1906, 1910. Chorionic villi projected through the small perforation of the ruptured and spouting right tube. In the single chorionic sac were twin embryos of about 6 weeks. Separate cords and amnia. Recovery. *Remarks.* Both papers deal with the same case. In 1906 the age of the embryos is given as 5 to 6 weeks, but in the 1910 contribution the age, based on the menstrual history, is placed at about 7 weeks. The true age, deduced from the menstrual history and accompanying illustrations, is obviously about 6 weeks.

Cargile, 1897. A ruptured left tube. Twin embryos were found in abundant clots. *Remarks.* From the history the embryos were probably 8 to 9 weeks old.

Carstens, 1920. The left tube was smooth and unruptured, 2½ by 1½ inches in size. It contained twin embryos, probably 11 millimeters long (6 weeks), within a common chorion. The right tube was ruptured and enlarged sufficiently to admit a thumb even to its uterine end; no fœtus or chorionic tissue was observed. *Remarks.* Some of the details have been gained by personal correspondence. The author is confident that, even in the absence of direct proof, the right tube represents a tubal abortion and in this he is doubtless correct. The twin embryos were "not more than three-fourths of an inch, if they were that long" when straightened out from their original "curled up" position. It is obvious that these statements exaggerate the true size of the embryos as customarily measured. The elapsed time between the last mensis and the operation suggests their age as not more than 6 weeks; if this is correct the true length should not be over 11 millimeters. The author estimates that the right tube "must have been a pregnancy of 6 weeks and the left one of about 3 weeks." For the left tube this is surely an underestimate. One thinks of the possibility of triplets, especially in light of the menstrual history; the author, however, is firm in his belief that the right tube "must have been far more advanced than the left one."

Child, 1907. A ruptured and bleeding left tube, from which twins, each 8 centimeters long (3 months) had been expelled. Single chorion and amnion; individual cords, one broken and its embryo free. *Remarks.* One regular period after the beginning of pregnancy. Last normal delivery was also twins.

Costa, 1907. The tube bore two swellings, well separated, the one at its uterine end the size of a walnut. Internally there is a single chorionic sac constricted into two incomplete compartments; each contains a male fœtus, 5.0 and 5.3 centimeters (10 weeks) respectively. *Remarks.* This specimen illustrates the last stage in a series demonstrating how separate chorionic sacs may fuse (Arey, 1922).

Danforth, 1920. One tube had ruptured in its ampullary region, producing a clot in which were found twin embryos.

Le Dentu, 1896. See Brodier, 1896.

Diamant, 1914. A ruptured right tube from which three embryos, each about 3 centimeters long (8 weeks) had been expelled. *Remarks.* There is one other authentic case of unilateral tubal triplets, that of Krusen, 1902.

Folet, 1895, 1896. A single sac, ovoid and compact, molded about two fœtus with their cords, and the débris of a placenta very degenerated. One a female fœtus at term (46 centimeters standing height); not a lithopedion. The other at about the third month, its head and thorax greatly compressed by the co-twin. Separate cords end in a single placenta. *Remarks.* In spite of the disparity in size these fœtus must be considered twins, according to the history dead for 15 years. The single placenta and gestation sac support this view. The amenorrhœa of the last three years doubtless signifies the normal menopause. A preliminary account of this case was published in 1895.

Grad, 1910. The right tube bore a single chorionic sac which had ruptured and expelled twin fœtus of 14 weeks. *Remarks.* This case appears in the literature simply as a comment appended to Pool's, 1910, society report. Further details have been gained by correspondence with Dr. Grad.

Hardouin, 1914, 1919. A ruptured and bleeding right tube had expelled twin embryos of about 3 centimeters (8 weeks). *Remarks.* The title heading of the appended figure designates the tube as "left"; this is obviously an error. There was one menstrual period after the onset of pregnancy.

Jacquemin, 1903. See Lucas-Championnière, 1903.

Johnson, G. W., 1915. A ruptured and bleeding left tube had expelled two embryos "of about 10 weeks" from a common chorionic cavity. These, with "a single placenta," were found in the abdominal cavity.

Kirchoff, 1894. The swollen and ruptured right tube was coated with coagulum; within its single chorionic sac are 11 millimeter twins (6 weeks) joined by their thoraces (thoracopagi). A common cord bifurcates as it passes to each embryo. *Remarks.* Rupture of the right tube and arrest of the 6 weeks' twins must have occurred a month before the operation. There must have been a single amnion.

Krusen, 1902. The right tube had ruptured and expelled three perfectly formed fœtus from its apparently common chorionic cavity. Fœtus in third month. *Remarks.* The author estimates the age as in the second month. From the illustration it is evident, however, that these triplets were well along in the third month. Hence development must have begun in the month preceding the last scanty flow. One other authentic case of unilateral tubal triplets is recorded by Diamant, 1914.

Launay, P., 1910. See Launay and Sequinot, 1911.

Launay and Sequinot, 1911. Both tubes ruptured; abortion into the abdominal cavity of 13 centimeter (12 centimeter?) twins (standing height) from the

right tube, and a single 13 centimeter fœtus (14 weeks) from the left. The twins are attached by separate cords to a single placenta and hence are monochorionic; the single fœtus has its own placenta. *Remarks.* It appears that the right tube aborted twins on October 21 (as evidenced also by older clots), accompanied by pains in the right side and vomiting; that the left tube aborted a single fœtus at the time of pains in the left side, November 10. It is evident there was one menstrual period after pregnancy had begun. This case was first briefly reported by Launay, 1910. The only other authentic case of triplets bilaterally distributed is that of Baldwin, 1913.

Lucas-Champonnière, 1903. The entire right tube enclosed a single, unruptured sac. Hæmorrhage occurred due to breaking of the vascular periphery. Within are twin fœtus of over 8 centimeters (3 months) connected by individual cords to a single placenta. Right ovary cystic and contains an enormous corpus luteum. *Remarks.* This case was also recorded by Jacquemin, 1903, who was an interne at the operation. For some unaccountable reason Costa, 1907, rejects this clear case from his positive list.

McCann, 1906. The left tube contains an ampullary dilatation, surrounded by a clot and containing a chorionic sac, 2½ by 3 centimeters. It is occupied by twin embryos with separate cords but enveloped in a single amnion. *Remarks.* Judging from the illustration the embryos must have been about 20 millimeters long, i.e., between the seventh and eighth week.

Michin, 1905. The left ruptured tube shows two cavities. In one are the remains of an old blood clot; in the other is a large fresh clot containing twin embryos. The left ovary bears a corpus luteum verum. *Remarks.* From the illustration the embryos are apparently about 15 to 20 millimeters long (7 weeks). The old blood clot in a separate cavity of the tube may well be the site of a ruptured gestation sac which had been removed per vaginam two years before.

De Ott, 1891. Tubal twins, 3 months, or perhaps a little more, in age. *Remarks.* No details are furnished; the entire report is in three lines.

Pool, 1910. See Pool and Robbins, 1910.

Pool and Robbins, 1910. In a single chorionic sac within the ruptured and bleeding tube were a clot and twins of 33 millimeters sitting height (9 weeks). The embryos are attached by separate cords to a single placenta and are enclosed by the torn remains of an apparently common amnion. *Remarks.* The limbs of one fœtus moved spontaneously for about a minute after exposure to air. Development of these nine-week embryos began a month before the last protracted flow. This case was reported independently by Pool, 1910.

Pulcher, 1905. At the middle of the left tube lies a tumor the size of a fist. Internally its cavity is divided by a thin, translucent septum into two unequal chambers. Each contains a well-preserved 2 centimeter embryo (7 weeks) whose cords are inserted in the center of the common septum. The two egg cavities are lined with individual amnia. *Remarks.* The common septum must represent the fused walls of two adjoining chorionic sacs—as the insertions of the cords testify. Degeneration of the villi here caused the retarded growth of the fœtus, which, according to the menstrual history, should be 12 to 14 weeks old. This specimen represents a stage in the fusion of separate chorionic vesicles which stands between the cases of Mall, 1915, and Costa, 1907; see Arey, 1922.

Rosenberger, 1906. The left tube was enlarged to the size of a baby's head. It contained two 3 months' fœtus, much flattened.

Rutherford, 1907. A ruptured left tube contains a single chorionic sac from which a placenta and twin embryos had been expelled. Separate amnia. *Remarks.* The illustration shows embryos of about 18 millimeters (7 weeks).

Saenger, 1893. In the interstitial portion of the right tube is a chorionic sac, 4 by 5 centimeters, containing twin embryos of 3 to 4 weeks; individual amnia. At the fimbriated end of the tube is a hazelnut-sized cavity surrounded by blood clots; its wall showed "beautiful decidual cells," but there was no actual embryo. The right ovary contains a corpus luteum verum. *Remarks.* The author considers this a case of triplets (the age is doubtless underestimated). It is, of course, possible, but since there is no embryo in one sac, and but one corpus luteum exists, it must necessarily remain doubtful. Decidual cells alone need not designate the exact location of a tubal pregnancy. Haultain, 1906, has convincingly shown that even the opposite uninvolved tube may contain them from end to end. So also in Salin's, 1895, case decidual cells were found in "both tube and tumors." Another case, apparently of interstitial twins, is that of Robinson, 1892.

Spinelli, 1904. In one tube were twins of 3 months. *Remarks.* The mucosa of the opposite tube showed a decidual reaction.

Strecker, 1892. The left tube, except its extreme ovarian end, comprises a rounded gestation sac, the size of an infant's head; through its ruptured wall placental tissue protrudes. Within are well-developed twin male fœtus, with separate amnia, and separate cords inserted near the middle of the placenta. *Remarks.* (The author's name is not Strocker, as repeatedly miscopied.) The breasts of the woman were greatly enlarged and yielded colostrum. This and the size of the tumor indicate that the fœtus were at least 3 months advanced.

Taylor, G., 1918. The swollen right tube had ruptured into the broad ligament and this secondary sac had in turn burst, as a projecting clot shows. In the blood clot of the broad ligament were found a complete 3.2 centimeter fœtus (8 weeks +) and the head and shoulders of another; the remaining portions were missing but it was surely the co-twin. A single primary gestation sac. *Remarks.* Rupture of the primary sac doubtless caused the first pains

recorded; 10 days later the secondary sac burst. There was one menstrual period after the onset of pregnancy.

Taylor, H. N., 1909. "A ruptured tubal sac with twin fœtus attached." *Remarks.* No further details are furnished except that the patient "believed herself 3 or 4 months along."

Young, 1911. Two separate sacs in the right tube. One sac was ruptured but its embryo not expelled. The second sac, unruptured, contains a twin to the first. *Remarks.* The photograph indicates an age nearer 3½ months. Possibly there was one menstrual period after pregnancy began.

Zunz, 1904. The right tube was torn for several centimeters; from its cavity had been expelled fœtus of 7 and 8 centimeters (11 weeks ±). Apparently a single cord. *Remarks.* A regular mensis, and bleeding a month later, came after the development of these 11 weeks' fœtus had begun.

2. PROBABLE CASES

Ferroni, 1903. The left tube presents two enlargements, separated by a small stretch of undistended normal tube. The dilatation nearer the uterus is the size of an egg; the other, the size of a walnut. These sacs are full of blood, fibrin, and detritus and show chorionic villi. Actual embryos not present. Left ovary has a corpus luteum undergoing regression. *Remarks.* The identity of structure of the two sacs, although of different size, and the history make it probable that this was a twin gestation of about 3 months' duration.

Mall, 1915. An unruptured tube bears a swelling the size of a walnut. Internally it contains two equal sacs, at almost the same transverse level, flattened and thinned on their surfaces of mutual contact. This common membranous septum is composed of the approximated chorionic walls, more or less separated by villi. Amnia and embryos have disintegrated totally. All villi show incipient hydatidiform degeneration. A small corpus luteum in the right ovary. *Remarks.* This case (Vest specimen, No. 825) is also described by Meyer, 1920. There is little doubt that these were double-ovum twins. The thin oppressed chorionic walls represent a preliminary stage in the fusion of double ova into a single vesicle (Arey, 1922). Pulcher, 1905, and Costa, 1907, have described specimens which illustrate later stages.

Meyer, 1920. See Mall, 1915.

Minchinard, 1896. A ruptured left tube and two unequal fœtus. The larger is an expelled normal female fœtus, 33 centimeters long (8 months ±). The other was found among clots in the sac; it is flattened and shrunken, 6.5 centimeters long. Each had an individual cord and placenta. *Remarks.* The author believes these fœtus are twins. The gestation sac is referred to as if it were single, and the photograph of the torn specimen rather supports this; on the other hand, there were separate placentæ. On the basis of the clinical history and the anatomical description, this case must be classified as probable or presumptive.

Robinson, 1892. Two embryos were passed on successive days. Curettement produced small pieces of placenta from the region of the right tubal ostium. The embryos were more than 13 centimeters long (14 weeks), but they had been compressed and elongated. Heads were mangled and sexes not distinguishable. *Remarks.* The author states: "It was undoubtedly an interstitial pregnancy on the right side. The shape of the uterine cavity, as disclosed by the several examinations, negatives the probability . . . of uterus bicornis." Lack of direct evidence eliminates this from the positive cases of tubal twins. Undoubted interstitial twins have been recorded by Saenger, 1893.

Rupin, 1860. The gestation sac, 20 centimeters in diameter, comprises the left tube and apparently its broad ligament. Within is a large placenta belonging to a 6 months' fœtus removed by colpotomy. Close to the placenta were found all the bones of a 4 months' fœtus. Left ovary atropic; the right ovary bears a corpus luteum. *Remarks.* Does the occupancy of a single sac and the existence of a single corpus luteum in the opposite ovary signify twins, one of which died at the fourth month and subsequently macerated? The additional evidence furnished by an attack of violent pain at the fourth month makes this appear probable.

Saniter, 1905. The right tube shows two enlargements. The larger is at the ovarian end, the size of an egg, and has a torn wall; it contains a fœtus of 4.0 centimeters. The smaller dilatation is 1 to 2 centimeters in diameter; it is near the uterus and about 2 centimeters distant from the larger sac; in its wall is a small punctate rupture, through which chorionic villi protrude. This smaller sac has macroscopic villi, but no embryo was found. The right ovary bears a large corpus luteum and a small corpus albicans; the left ovary was not inspected. *Remarks.* The history indicates that on April 15 the smaller dilatation ruptured and its embryo underwent expulsion or resorption; the other ovum continued development until its rupture on May 5. The single corpus luteum, however, does not favor this interpretation. There may have been one menstrual period after pregnancy had begun.

Schauta, 1905. In the right tube are two gestation sacs: One, 4 by 5 centimeters, contains a macerated fœtus 6 centimeters long (12 weeks); the other is 1½ by 2 centimeters but contains no fœtus. Both sacs are highly hæmorrhagic. *Remarks.* It is probable that this is a twin pregnancy in which one embryo died during the first two proximal attacks and was subsequently resorbed, whereas the second embryo was unaffected until the severe internal hæmorrhage a month later.

Treub-Cullen. In a personal communication to Pool and Robbins, 1910, Dr. T. S. Cullen states that while in Amsterdam Prof Treub "gave me a picture showing five embryos apparently between three and four months. They came from a tubal pregnancy.

This case did not come under Dr. Treub's personal observation, but occurred in the service of a colleague in one of the other Dutch cities." McCalla, 1909, reports Dr. Cullen as stating in a personal letter that all five embryos were in one tube. McCalla further cites Dr. Cullen as having seen several cases of twin tubal pregnancy and bilateral pregnancy; on the contrary, Pool and Robbins quote him as follows: "Personally I have not had any cases of twin tubal gestation. *Remarks.* Quintuplets in one tube are unique. Owing to the lack of direct proof of the authenticity of this remarkable case, and the paucity of details furnished, it can scarcely be admitted to the positive list.

3. POSSIBLE CASES

Fenger, 1891. The left tube had ruptured and expelled a single embryo still connected by its cord to a placenta within. The embryo is said to be in its second month. Nearer the uterus was a second ovum, degenerated and cystic, measuring 1 by 1½ inches. *Remarks.* This is at best a doubtful case of twins.

Handley: Cameron, 1906, refers to Handley who had examined a case of unilateral ectopic twins of unequal size. As no further details are furnished this must rank as a doubtful case.

Johnson, F. W., 1894. The right tube is enlarged to a dark red egg-shaped mass, 3 by 4 centimeters: its interior is a blood clot containing thread-like masses, evidently chorionic villi. The ovarian end of the left tube is dilated into a rounded shell, 1.5 by 2.5 centimeters; a protruding clot is continuous with a mass filling its interior, which contains structures resembling very poorly formed villi. In the wall of the left tube, near its uterine end, is a small clot containing numerous small branching villi. In the right ovary is a "yellow opaque body"; in the left ovary a corpus luteum verum, 1 centimeter in diameter. *Remarks.* The anatomical report (by Dr. Whitney) apparently reverses the designation of the tubes as right and left. The regressive changes are so nearly complete that the true condition (twins, triplets, or successive pregnancies) remains in doubt.

Salin, 1895. The enlarged right tube bears two dilatations: one, near its ovarian end, is the size of an egg; the other, close to the ovary, is the size of an almond. The two sacs have plain walls and are filled with normal blood. Hasty examination showed the presence of decidual tissue in "both tube and tumors." *Remarks.* The author considers this a twin pregnancy; although plausible in view of the clinical history, it must remain a doubtful case. (See remarks on decidual cells under Saenger's case, 1893.)

SUMMARY

The essential anatomical facts from all existing cases of tubal twin pregnancy have been concisely summarized and made accessible.

This enumeration shows that 40 cases (including two new specimens) describe positive or authentic cases. Eight are probable or presumptive. Four are possible but doubtful.

Two new specimens of single-ovum tubal twins are described, thereby increasing the authentic total to forty. One pair has a common yolk-sac, thus for the first time furnishing direct proof of the origin of human homologous twins from a single egg. The other twin pair may have resulted from an unequal division through which one individual received essentially the entire yolk-sac. Hence the yolk-sac appears as a vestige unessential physiologically to growth or differentiation.

BIBLIOGRAPHY

ALBERTIN. Grossesses ectopiques. Lyon méd., 1903, ci, 1020-1024.

AMANN. Zwillingsschwangerschaft in einer Tube. Zentralbl. f. Gynaek., 1908, xxxii, 798.

ANDREWS, H. R. A case of twin pregnancy in a fallopian tube. Proc. Roy. Soc. Med., 1909, ii, Obst. & Gynec. Sect., 228-229.

AREY, L. B. Chorionic fusion and augmented twinning in the human tube. Anat. Rec., 1922, xxiii, 253-262.

BALDWIN, J. F. Two unusual cases of ectopic pregnancy. One a triplet. J. Am. M. Ass., 1913, lxi, 392.

BARBAT, J. H. Report of three cases of ectopic pregnancy. Pacific Rec. Med. & Surg., 1899, xiii, 213-217.

BASHAM, D. W. Report of a case of extra-uterine pregnancy, with twins, complicated with ovarian fibroid on the opposite side. Tr. West. Surg. Ass., 1909, 281-283.

BERTINO, A. Gravidanza tubarica gemellare monochoriale e monamniotica. Ginecologia, 1911, viii, 52-57.

Idem. Un quinquennio alla clinica ostetrico-ginecologia di Firenzi., 338 pp. Sassari: G. Gallizzi e Co.

BOEHMER, P. A. Observationum anatomicarum rariorum etc.; pars 2. Halae Magdeburgicae, apud I. I. Gebaverum, 1752.

BRAHAM, N. Twin tubal pregnancy with tubal abortion of one twin. Brit. M. J., 1914, ii, 239.

BRODIER. De la grossesse tubaire gémellaire. Rev. internat. de méd. et de chir., 1896, vii, 130-131.

CAMERON, S. J. M. Some pathological considerations of extra-uterine pregnancy. Lancet, Lond., 1906, ii, 1775-1777.

Idem. Twin tubal pregnancy. Proc. Roy. Soc. Med., 1910, iv, Obst. & Gynec. Sect., 149-151.

CARGILE, C. H. Twin tubal gestation. Am. Gynec. & Obst. J., 1897, x, 53-54.

CARSTENS, J. H. Double tubal pregnancy: one twins. J. Am. M. Ass., 1920, lxxiv, 1518.

CHILD, C. G. Twin tubal pregnancy. J. Am. M. Ass., 1907, xlix, 2134-2135.

COSTA, R. Intorno alla gravidanza tubarica gemellare di un lato. Ann. di ostet. e ginec., 1907, xxix 185-212.

DANFORTH, W. C. Report of a case of ruptured ectopic single ovum twin pregnancy. Surg., Gynec. & Obst., 1920, xxxi, 199.

LE DENTU. Présentation de deux embryons provenant d'une grossesse tubaire gémellaire à sac unique. Bull. Acad. de méd., Par., 1896, xxxv, 214-215.
DIAMANT, Z. Ein Fall von Drillingsschwangerschaft in demselben Eileiter. Zentralbl. f. Gynaek., 1914, xxxviii, 128-129.
FENGER, C. Tubal pregnancy with two ova in the same fallopian tube. J. Am. M. Ass., 1891, xvi, 564.
FERRONI, E. Beitrag zum Studium der tubaren Zwillingsschwangerschaften in derselben Tube. Zentralbl. f. Gynaek., 1903, xxvii, 275-281.
FOLET. Grossesse extra-utérine gémellaire datant de quinze ans. Gaz. méd. de Par., 1895, lxvi, 127.
Idem. Grossesse extra-utérine gémellaire probablement tubaire. Ann. de gynéc. et d'obst., 1896, xlv, 190-198.
GRAD, H. Comment on Pool's, 1910, report. Med. Rec., 1910, lxxvii, 551.
HANDLEY, W. S. Cited by Cameron, 1906.
HARDOUIN, P. Grossesse extra-utérine gémellaire. Bull. et mém. Soc. anat., Par., 1914, lxxxix (1914-1919), 6e série, xvi, 164-166.
Idem. Grossesses extra-utérines gémellaires unitubares. Arch. mens. d'obst. et gynéc., 1919, viii, 331-341.
HAULTAIN, F. W. N. A clinical experience of ectopic pregnancy and allied conditions. J. Obst. & Gynæc., Brit. Emp., 1906, ix, 403-411.
JACQUEMIN. Grossesse tubaire gémellaire. Bull. et mém. Soc. anat., Par., 1903, v, 276-277.
JOHNSON, G. W. A case of twin ectopic pregnancy. Lancet, Lond., 1915, ii, 869.
JOHNSON, F. W. Six cases of extra-uter ne pregnancy. Boston M. & S. J., 1894, cxxx, 256-259.
KIRCHOFF. Ein Thorakapagus im tubaren Fruchtsack. Zentralbl. f. Gynaek., 1894, pp. 232-233.
KRUSEN, W. Triple ectopic gestation. Am. Med., 1902, iii, 18-19.
LAUNAY, P. Grossesse extra-utérine bilatérale simultanée, gémellaire d'un côté. Bull. et mém. Soc. chir., Par., 1910, xxxvi, 1117-1118.
LAUNAY, P., and Sequinot. D'un cas de grossesse tubaire à trois foetus. Rev. d. Chir., 1911, xliii, 401-419.
DE LEE, J. B. The Principles and Practice of Obstetrics. Philadelphia: W. B. Saunders & Co., 1918, 1089 pp.
LEWIS, H. F. Simulated unilocular twin ectopic pregnancy. Surg., Gynec. & Obst., 1921, xxxiii, 195.
LUCAS-CHAMPONNIÈRE. Inondation péritonéale due à une grossesse gémellaire de la trompe droite. Bull. et mém. Soc. chir., Par., 1903, xxix, 327-328.
MALL, F. P. On the fate of the human embryo in tubal pregnancy. Carneg. Inst. of Wash., Contr. to Embryol., i, no. 1, pp. 1-104.
MARTIN, A. E. Handbuch der Krankheiten der weiblichen Adnexorgane. Leipzig: E. Besold, vol. i, 411 pp.
MCCALLA, L. P. Twin tubal pregnancy and bilateral tubal pregnancy. Surg., Gynec. & Obst., 1909, viii, 248-254.
MCCANN, F. J. Twin tubal pregnancy. J. Obst. & Gynæc., Brit. Emp., 1906, x, 628-631.
MCDONALD, E., and KRIEGER, W. A. Bilateral and multiple ectopic pregnancies. J. Am. M. Ass., 1913, lx, 1766-1769.
MEYER, A. W. Hydatiform degeneration in tubal and uterine pregnancy. Carneg. Inst. of Wash., Contr. to Embryol., 1920, ix, no. 40, 325-364.
MICHIN, P. Wiederholte Extrauterinschwangerschaft in ein und derselben Tube; Zwillinge. Monatschr. f. Geburtsh. u. Gynaek., 1905, xxii, 455-457.
MINCHINARD, P. A case of plural ectopic gestation. Am. J. Obst., 1896, xxxiv, 36-40.
DE OTT, D. Ann. de gynéc., 1891, xxxvi, 304.
PARRY, J. S. Extra-Uterine Pregnancy, etc. Philadelphia: H. C. Lea, 1876, 276 pp.
POOL, E. H. Unilateral twin pregnancy. (N. Y. Acad. Med., Sect. Obst. & Gynec., meeting of Dec. 23, 1909.) Med. Rec., 1910, lxxvii, 551.
POOL, E. H., and ROBBINS, F. Unilateral twin tubal gestation. Am. J. Obst., 1910, lxi, 606-614.
PULCHER, J. Zwillingsschwangerschaft in der Tube. Inaugural-Dissertation, Universitaet zu Heidelberg, 1905. H. Doerr, 30 pp.
ROBINSON, A. L. A case of twin extrauterine. New York M. J., 1892, lv, 690-691.
ROSENBERGER, A. Tubáris ikerterhesség. Orvosi Hetil., 1906, li, 35.
RUPIN, E. Grossesse extra-utérine double. Gaz. d. hôp., 1860, xxxiii, 63.
RUTHERFORD, A. F. Twin ovum in a tubal pregnancy. Lancet, Lond., 1907, i, 881-882.
SAENGER. Ueber einen Fall von ektopischer Drillingeschwangerschaft. Zentralbl. f. Gynaek., 1893, xvii, 148-150.
SALIN, M. Fall af tubar tvillingsgraviditet. Förhandlingar vid Svenska Läkare-Sällskapets, 1895, pp. 180-184.
SANITER, R. Tubare Zwillingsschwangerschaft mit zwei Eiern verschiedener Groesse. Ztschr. f. Geburtsh. u. Gynaek., 1905, lv, 492-496.
SCHAUTA. Tubare Zwillingsschwangerschaft. Zentralbl. f. Gynaek., 1905, xxix, 45-46.
SCHRENK, H. VON. Ueber ektopische Graviditaet. Inaugural dissertation, Dorpat, 1893.
SCHROEDER, K. Lehrbuch der Geburtshuelfe. Bonn: Cohen u. Sohn, 1888, 834 pp.
SPINELLI, P. G. Un caso di gravidanza gemellare tubarica. Atti d. Soc. ital. di ostet. e ginec., 1904, x, 216-217.
STRECKER. Ein Fall von Extrauterin-Zwillingsschwangerschaft. Verhandl. d. Berl. med. Gesellsch., 1892, xxiii, 83-84.
TAYLOR, G. Ectopic gestation; a case of twins in one gestation sac of tubal origin. Brit. M. J., 1918, i, 722-723.
TAYLOR, H. N. A ruptured tubal gestation with twin fœtus. Lancet, Lond., 1909, i, 23.
TREUB-CULLEN. Cited by Pool and Robbins, 1910, and McCalla, 1909.
WEBSTER, J. C. Die ektopische Schwangerschaft. Berlin: S. Karger, 1896, 219 pp.
WEIBEL, 1905. Cited by De Lee, 1918.
VON WINCKEL, F. Handbuch der Geburtshuelfe. Wiesbaden: Bergman, 1903-1907, ii, No. 2.
YOUNG, H. C. T. Unilateral twin tubal pregnancy. Austral. M. Gaz., xxx, 736-739.
ZUNZ, L. Erfahrungen ueber Tubargraviditaet. Arch. f. Gynaek., lxxiii, 22-56.

DEPARTMENT OF TECHNIQUE

A NEW TECHNIQUE FOR THE CLOSURE OF THE ABDOMEN

By RODOLFO E. PASMAN, M.D., F.A.C.S., Buenos Aires, Argentine
Surgeon to the Dawson Hospital

ALL surgeons have had trouble in some cases of acute abdomen in closing the peritoneal layer. It is only by giving the patient such large doses of ether or chloroform as to produce complete muscular relaxation, that the operator is able easily to approximate the different layers of the abdominal wall. To overcome the difficulties encountered in closing the wound, I have for some years used the technique described.

First, I place sterile gauze over the protruding omentum and intestine to protect it from contamination (Fig. 1). Then I place three or four isolated strong catgut sutures through all the layers of the abdomen except the skin, later starting the suture of the peritoneum alone with a continuous mattress suture which is left loose. I tie the three or four isolated stitches one after the other (Fig. 2) and slowly remove the protecting gauze. By making traction slowly and firmly at the end of the mattress suture (Fig. 2), I bring into perfect approximation the edges of the peritoneal layer. The rest of the wound which is no longer under such tension, is closed in the same manner, the closure of the serosa being finally easily accomplished.

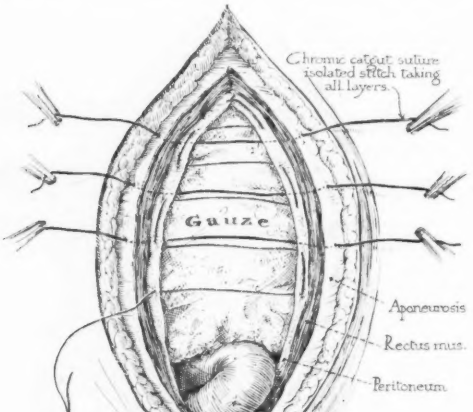


Fig. 1.

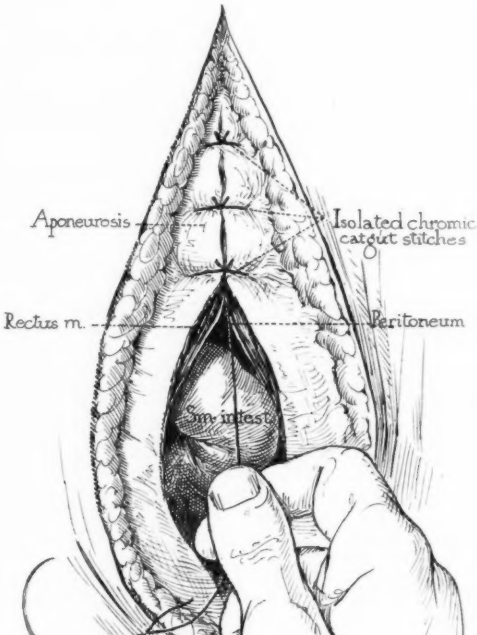


Fig. 2.

IDENTIFICATION OF THE COMMON BILE DUCT IN THE PRESENCE OF AN ANOMALOUS CONDITION OF THE BILIARY PASSAGES

By JOHN HOMANS, M.D., F.A.C.S., Boston
From the Surgical Clinic of the Peter Bent Brigham Hospital

An exceedingly short cystic duct is one of the infrequent but important anomalies of the bile passages. The common duct is then so closely attached to the gall bladder as to appear to emerge from its wall. Much the same effect obtains when long-standing inflammation renders the two particularly adherent, but the congenital anomaly is the more deceptive. For in performing cholecystectomy under these circumstances, when the peritoneum and retroperitoneal fat have been divided from the ampulla of the gall bladder across the edge of the gastrohepatic omentum and traction is being made upon the ampulla, the common duct is disclosed passing downward and inward from the gall bladder in the position and direction usually taken by the cystic duct. Unless the operator is particularly vigilant he is likely to clamp and divide this duct for its anatomical relations, *more especially when the dissection is easy and the exposure good*, are little likely to awaken his suspicions.

A very constant and satisfactory means of identifying the common bile duct (once the peritoneum and fat are dissected from it) is the presence of a blood vessel which passes longitudinally along its anterior surface. There may be visible a small tortuous artery but what perhaps catches the eye more readily is the vein or group of veins which accompanies it. Such vessels are never seen upon the wall of the cystic duct, nor does the cystic artery offer a possibility of confusion since its course to the gall bladder is well away from the duct. Theoretically the operator should expect to see a small, beaded or spirally marked tube when he is looking for the cystic duct, but long-standing dilation and thickening may obliterate these markings and render the tube as cylindrical and as large as the common duct. The presence of a visible blood vessel in the wall of a biliary passage should suggest at once that it is the principal biliary channel to the duodenum and not the cystic branch.

The accompanying diagrammatic sketches show:

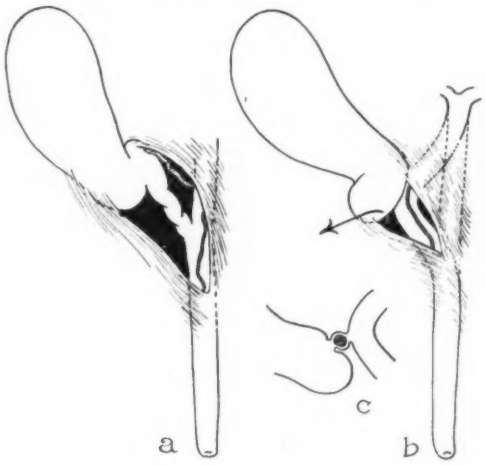
a. The appearance and relations of the gall bladder, the cystic and the common ducts when the peritoneum over them has been widely split and retracted. The presence of the characteristic vessel in the wall of the common duct is disclosed. It will be noted that the cystic artery does not accompany the cystic duct.

b. The appearance and relation of the common duct to the gall bladder when the former is angulated and drawn into the position of the normal cystic duct by traction upon the ampulla. The sketch is based upon two almost identical operative cases. The peritoneum over the common duct has been split as in Figure *a*.

c. The fully dissected region of the cystic duct itself. The duct is shown blocked by a small stone. Such a condition was present in one of the two cases. In the other, the cystic duct was even shorter and more difficult to identify.

The writer believes that anomalies such as this, as well as others of the ducts and blood vessels which Eisendrath[1] has recently so well described and figured, should warn surgeons to perform cholecystectomy only by the sense of sight through dissections as open as circumstances permit. He is convinced that any difficulty in identifying the cystic duct should lead the operator to enucleate the gall bladder from the fundus inward and even to leave a bit of gall-bladder wall behind rather than to run a risk of injury to the common duct.

[1] Eisendrath, D. N. Operative injury of the common and hepatic bile ducts. Surg., Gynec. & Obst., 1920, xxxi, 1.



OVERHEAD ELEVATOR

By PAUL N. JEPSON, M.D., Rochester, Minnesota
Fellow in Orthopædic Surgery, The Mayo Foundation

THE handling of patients who must be kept quiet and on their backs or faces for any length of time necessitates the employment of some special apparatus by means of which their care may be facilitated. Such an apparatus has been devised in the Section on Orthopædic Surgery of the Mayo Clinic, with the object of immobilizing the patient, increasing his comfort, and lessening the work of the nurse.

The apparatus consists, first, of a modified Balkan overhead frame; second, a Bradford frame on which the patient is placed; and, third, an elevating appliance which is attached to the bed.

The Balkan frame was modified so as to facilitate its transportation from one room to another, and also to make it adjustable to any bed. The top can be lifted off (Fig. 1*b*) and the entire frame changed from one room to another in a few minutes.

The Bradford frames are made from ¾ inch gas pipe and the bed portion is made of canvas and laced to the pipe frame with rawhide thongs (Fig. 1*d*). An opening is left at the buttocks.

The elevating appliance is made to attach to the posts at the foot of the bed. It consists of a shaft, a crank, a Ford timing gear, and two enema can-holders used as hangers for the shaft. To one of the hangers is attached a simple "dog" (Fig. 1*e*) by means of which the elevation of the frame can be controlled. The crank is left loose in the shaft so that the handle part may be turned in, out of the way (Fig. 1*e*). Four steel eyes are riveted into the shaft through which the ropes are tied. Ordinary window-sash cord may be used.

By means of a ¼ inch steel hook, a 2 inch double awning pulley is attached to each corner of the Bradford frame. These pulleys have one eye. To each corner of the Balkan frame is attached a 2 inch double pulley with two eyes. The ropes are then threaded block-and-tackle fashion and tied to the crank shaft at the foot of the bed. Two additional double pulleys are bolted to the cross bar at the foot of the frame to guide the ropes to the crank shaft.

When the patient uses the bed pan, the frame is elevated 6 or 8 inches by turning the crank;

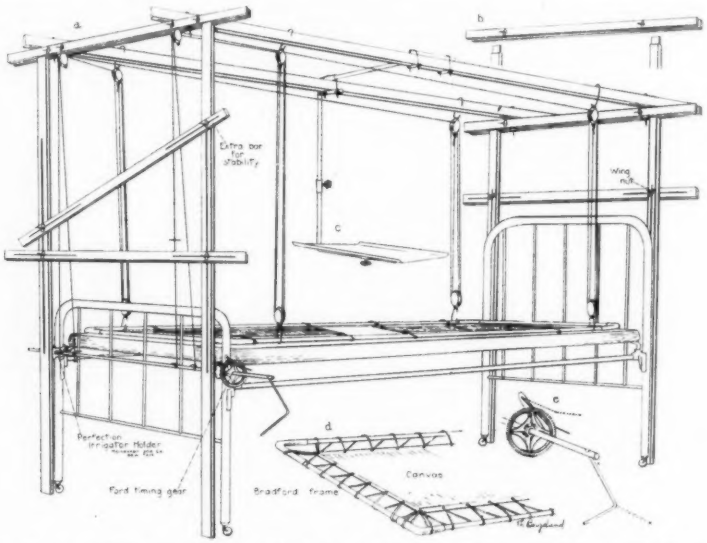


Fig. 1. *a*, Balkan frame; *b*, method of knocking down frame; *c*, table; *d*, Bradford frame; *e*, gear with "dog" and adjustable crank.

this elevation is held by means of the "dog" which locks the Ford timing gear and keeps the patient from slipping. The pan may be placed beneath the frame and the patient left alone. If the patient is incontinent, the frame may be elevated 2 or 3 inches and the bed clothing kept perfectly dry.

These frames have been used satisfactorily for patients on whom Albee bone graft operations and Hibbs operations for tuberculosis of the spine have been performed; also for patients with fractures of the pelvis, and fractures of the femur put up in double spica casts of the hip; for patients who have had laminectomies, for patients with transverse myelitis with incontinence, and for old debilitated patients.

The cost of the entire structure, including bolts, pulleys, and so forth, is less than ten dollars.

AN INSTRUMENT TO FACILITATE THE THREADING OF SURGICAL NEEDLES

By FREDERICK S. RICHARDSON, B.S., M.B. Minneapolis, Minnesota
From the Department of Surgery, University of Minnesota Medical School

SURGEONS working with fine needles such as are used in eye, nerve, blood-vessel, and intestinal operations are often delayed because of the time required for threading fine-eyed needles. Self-threading needles have been offered as a solution of this problem, and, indeed, are used by many surgeons who specialize in delicate work. However, after a few sterilizations this type of needle becomes rusty and cuts the ligature.

To avoid delay attending the threading of needles, the instrument described has been devised and has proven satisfactory with the finest needles. A search of the literature has not revealed a similar device.

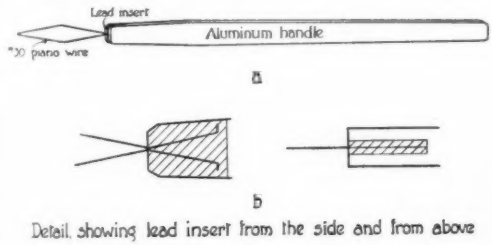


Fig. 1

Fig. 1. Diagram of completed instrument.

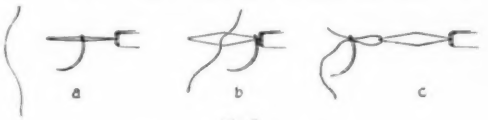


Fig. 3

Fig. 3. Steps in procedure.

In brief this is a loop of very fine silver-plated piano wire of .003″ to .009″ in diameter bent into an elongated diamond shape, three-quarters or one inch in length, and placed in a suitable handle of aluminum 4 inches in length (Fig. 1, *a*).

The ends of the wire that fasten into the handle are bent at right angles at their ends and are placed between two thin sheets of lead. The lead is then pressed and the wire imbedded in the same. The lead and wire are inserted into a narrow slot in the aluminum handle (Fig. 1, *b*).

The handle is firmly pressed down on the lead and wire. This method insures holding the wire firmly in the handle without solder, which would tend to take the temper out of the piano wire.

Fig 2.

Fig. 2. Drawing showing position of hands.

To protect the wire when not in use, a pencil cap may be slipped over the end. The needle threader should be chemically sterilized, as by carbolic and alcohol, rather than by boiling, so as to insure long life to the temper. However, the instrument will stand many subjections to heat, one of them having been sterilized by boiling repeatedly without evident impairment.

TECHNIQUE

The ligature is picked up between the thumb and forefinger of the left hand so that about 1 inch of the free end protrudes above the fingers. The needle is then grasped between the same thumb and finger as the thread, and the threader is grasped between the thumb and forefinger of the right hand. The lower fingers are in contact, steadying the manipulation (Fig. 2). The point of the diamond-shaped loop is thrust through the eye of the needle (Fig. 3, *a*), and after the loop has expanded on the other side of the eye, the needle is dropped by the left hand and the ligature is passed through the loop (Fig. 3, *b*), the needle regrasped by the left hand and the loop redrawn, carrying the ligature through the eye of the needle (Fig. 3, *c*).

The use of this device at the University Hospital and in the laboratory of surgical research has proven to be a time and labor saver.

A SIMPLIFIED "TOWEL CLIP"

By L. M. STEARNS, M.D., Kearney, Nebraska

NEW methods of technique in operative procedure are always of interest to the surgeon, and any means of simplifying the work always appeals to one.

It has always appeared to me that since with the ordinary towel clip, it is necessary to use from four to six or more of them, there are too many instruments about the field of operation. Not only that, but many hesitate to apply the clips in such a way as to transfix the skin. If the skin is not transfixed the towels frequently slide over the wound margin and thus are apt to carry bacteria from the skin over into the depths of the wound.

The "clips" I have designed are used in pairs, one applied to each end of the incision. The clip consists of three armed hooks, one stationary and two of which slide in a square bar and are adjustable, holding the clip in position automatically. The central hook has a small nob fused on the outer curvature to prevent the towels from riding over it, as shown in cut.

The incision is made down to the deep fascia with one stroke of the knife. The knife may then be re-carbolized. The superficial fascia is freed from the deep fascia for about ¼ inch on each side: this provides better exposure. Then a towel

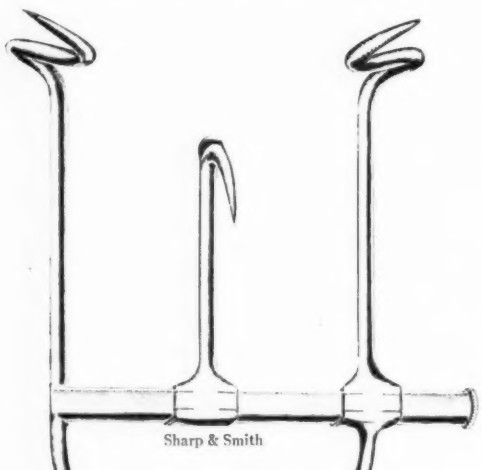


Fig. 1. Drawing of instrument.

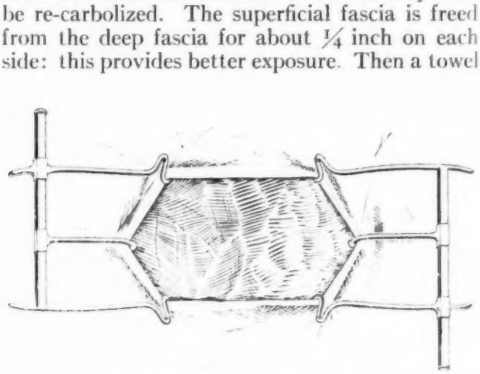


Fig. 2. Instrument applied.

is placed on each side of the incision, the borders folded over the skin about one-quarter inch and overlapping at the ends of the incision.

The central hook is placed through the towels and immediately under the skin at the end of the incision. The lateral hooks are tilted down and engaged through the towels on either side of the wound, penetrating the areolar tissue and the arms spread the desired distance. Additional towels may be used to cover the cross bars at each end.

ADVANTAGES

The advantages may be summed up as follows:

1. They lay flat and are out of the way.
2. They lessen the number of instruments about the field of operation.
3. They do not interfere with the use of larger retractors in the depths of the wound.
4. They positively prevent the towels from slipping when properly adjusted.
5. They do away with the necessity of suturing towels to the peritoneum or other membrane and the unnecessary trauma caused thereby.
6. They do not perforate the skin, and lessen the likelihood of carrying bacteria into the wound.
7. They "stay put" until the operation is complete and are easily removed after the fascia is sutured.

A "TWO-FORCEPS MANŒUVRE" FOR PERSISTENT OCCIPITOPOSTERIOR PRESENTATION

By SAUL SEIDES, M.D., New York

Associate Obstetrician, Jewish Maternity Hospital; Assistant Gynecologist and Obstetrician, Israel-Zion Hospital of Brooklyn; Assistant Gynecologist, Out-Patient Department, Beth Israel Hospital

THE management of persistent occipitoposterior presentation has been a constant source of anxiety to the obstetrician. Unsatisfactory results in this class of obstetric cases may be traced largely to two causes:

1. To the fact that this complication is frequently overlooked and consequently the patient is not watched with sufficient care and is not treated in accordance with the requirements of her case; and
2. To the fact that the methods of delivery of such cases in vogue at the present time are complex, difficult, and uncertain.

As soon as the malposition is recognized, proper care should be exercised in conducting the first stage of labor to safeguard the interests of the patient. The number of vaginal examinations must be limited to a minimum. The membranes should be kept intact as long as possible. The patient should be protected against exhaustion by rest and suitable doses of morphine. (The latter also helps to soften the cervix and aids dilatation.) The policy of intelligent expectancy must be strictly adhered to. The natural forces must be permitted to work to correct the malposition and at the same time watch must be kept for the signs indicating maternal exhaustion and fœtal danger.

In dealing with a persistent occipitoposterior position—that is to say, when the posterior position persists beyond the point of safety for mother or child, and the labor must be terminated by resorting to artificial means—we are confronted by the problem of choosing the method of delivery suitable for the particular case at hand. We ordinarily think of one of the following methods, every one of which has its warm and distinguished advocates:

a. Manual rotation of the head followed by forceps extraction;

b. Forceps rotation and traction synchronously carried out;

c. Forceps extraction with the occiput remaining posteriorly;

d. Version; and

e. Forceps rotation followed by reapplication and extraction (double application of forceps).

Manual rotation requires considerable intra-

pelvic and intra-uterine manipulation and is not always successful even in the hands of the most skillful obstetrician. De Lee advocates grasping the scalp with a tenaculum forceps after manual rotation, in order to prevent the head from slipping back to its former position.

The method of forceps delivery by rotation and traction synchronously carried out is the favorite method and most commonly employed in spite of the fact that this method, next to the one of extraction with the occiput in the posterior position, requires excessive force. It is the most difficult to perform and is attended by serious injuries to mother and babe.

Version as a method of procedure in the occipitoposterior cases does not readily appeal to one especially where the uterus is exhausted and the amniotic fluid has drained off a long time before.

The manœuvre of double application of forceps, originated by Sconzoni, is based on the rational principle that before traction is made on the head, the occiput must be brought under the symphysis by correcting the malposition. For it is only when this position is corrected that brute force will be avoided. Sconzoni's manœuvre is carried out as follows:

The forceps are applied so that the points of the blades are directed toward the babe's forehead, and the head is rotated from the oblique to the transverse diameter of the pelvis. The forceps are then removed and reapplied with the points of the blades directed toward the occiput, and the rotation continued until the occiput is brought under the symphysis. Then traction is used and the delivery completed.

But Sconzoni could employ his method only when the head was on the perineum. When the head is at a higher level, Sconzoni's manœuvre can be carried out only after the head has been pulled down to the pelvic floor—a procedure which is both difficult and dangerous.

A few years ago Bill, of Cleveland, described a modification of Sconzoni's manœuvre. He makes a cephalic application in whatever plane of the pelvis the head happens to lie, and brings the occiput directly under the symphysis with one gentle sweep of the handles of the forceps. Bill's manœuvre, while easily carried out, has two objectionable features: (1) the head is sometimes turned to a degree that involves a dangerous twisting of the neck of the fœtus; (2) when the blades are removed to be reapplied, the head tends to turn back to its former position and the rotation has to be repeated.

While endeavoring to render the forceps operation in cases of persistent occiput posterior position both safe and successful, I evolved a new manœuvre which for several years I have employed with the most gratifying results.

The steps of the operation are as follows: The exact location of the head in the pelvis is ascertained and the forceps are introduced with the points of the blades directed toward the face of the fœtus, and are so adjusted that they grasp the head in a true cephalic manner and the blades lie parallel with the sagittal suture (Fig. 1).

I find that the introduction of the anterior blade first makes the adjustment of the forceps easier. The forceps lock perfectly if the application is a correct one.

Before rotation is begun, the head, which in the occipitoposterior positions is somewhat extended, is first flexed by shifting the handles of the forceps in a straight line to a point diametrically opposite the one at which they were originally (Fig. 2). Now the head is rotated by gently moving the handles first downward and outward (Fig. 3), then downward and inward (Fig. 4), thus describing an arc of a circle. At the same time, using abdominal manipulation, the nurse or assistant turns the body of the fœtus so as to bring its back forward. The movement of the forceps is continued until the blades become inverted and the small fontanelle is felt under the symphysis (Fig. 5). Now the blade on the left side of the pelvis is removed, and the left blade of another pair of forceps, which I have at hand, is introduced (Fig. 6); then the inverted blade on the right side of the pelvis is removed and the right blade of the other pair of forceps is introduced (Fig. 7). The second forceps is now locked and the

delivery is completed by a simple extraction of the head with the occiput in the anterior position.

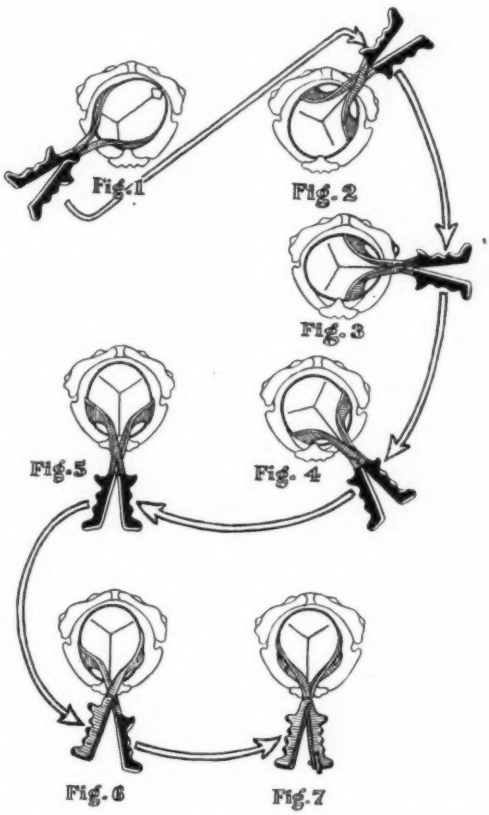
The simultaneous rotation of the body and head obviates the possibility of excessive tortion of the neck. The employment of the two pairs of forceps, with the alternate removal and application of their respective blades, counteracts the tendency of the corrected head to rotate back into its former position after the removal of the first forceps. The blade remaining in the pelvis during the application, acts as a splint supporting the head in its new corrected position. Since two sets of blades are required for this operation I have named it "two-forceps manœuvre."

This manœuvre is carried out with the utmost ease and with the least consumption of time. No force whatsoever is required. The safety of the manœuvre is attested by an analysis of the cases reported below.

I have employed the "two-forceps manœuvre" in 60 consecutive cases of persistent occipitoposterior position. All of these cases were carefully watched and every opportunity afforded for spontaneous rotation. Artificial delivery was resorted to only when it became clearly evident that further delay in terminating labor would jeopardize the well-being of mother or child.

The indications for interference as regards the mother's condition were: secondary inertia appearing after a period of strong, frequent, and agonizing pains; marked increase in pulse rate; and a rise of temperature. The points watched for as regards the fœtus' condition were: excessively rapid or excessively slow and irregular fœtal heart sounds; and the appearance of meconium. In the presence of the above danger signs, artificial delivery was resorted to irrespective of whether the head was high up or low down in the pelvis and whether or not the cervix was completely dilated. Among the 60 cases there were 7 in which the manœuvre had to be carried out with the cervix incompletely dilated, and 5 in which the head was at the inlet.

In this series of 60 cases, there were primiparæ 39, multiparæ 21; right occipitoposterior was encountered 33 times, left occipitoposterior 23 times, occipitosacral 4 times. The average duration of arrested progress (or period of watchful expectancy) was 4 hours. Morphine was used in the first stage in 28 cases. In 24 cases pituitrin was employed one or more times in the expectation that the increased strength of the uterine contraction might effect a spontaneous rotation of the head. I wish to remark here that the employment of pituitrin in cases of persistent occipitoposterior is attended with a definite risk, for, in the presence of obstruction to the progress of the head, the use of pituitrin increases the likelihood of asphyxia due to cerebral compression and interference with placental circulation. But whenever employed I had the forceps ready and the



Figs. 1 to 7 illustrate steps in "two-forceps manœuvre."

TABLE OF SIXTY CASES OF PERSISTENT OCCIPITOPOSTERIOR POSITION

Chart number	Name (initials)	Age	Para	Position	Duration of labor (*=hours in hosp.)	Rupture of membranes (hrs. before delivery)	Arrested progress (hours)	Cervical dilatation at time of delivery	Location of head in pelvis	Medication during labor (morphine, pituitrin)	Maternal injuries	Fœtal injuries	Fœtal mortality	Maternal morbidity	Fœtal morbidity	Weight of baby	Condition of bladder	Condition on discharge	Remarks
16013	R.E.	26	I	R.O.P.	28½	14	10	Full	Medium	Morph. (1) Pit. (2)	Superficial tear	None		None	None	7 lb. 10 oz.	None	Good	
16153	M.S.	23	I	R.O.P.	26*	0	3	Incomplete	Medium	Morph. (1) Pit. (2)	Laceration of cervix	None		None	None	8 lb. 9 oz.	None	Good. Cervical lac. healed	Irregular. Very rapid fœtal heart sounds. Mother's Temp. 100°. Pulse 100° Baby resuscitated. 2 sutures for cervical tear
16454	A.C.	34	I	R.O.P.	22*	13	4	Full	Medium	Morph. (1)	Median episiotomy	None	Still born	Temp. 102° for 13 da.			Cath. (5) days	Cerv. lac.	No fœtal heart 4 hrs. before delivery. Albumin and casts in urine
16623	S.S.	23	I	R.O.P.	8*	4	4	Full	Medium	None	Med. epis.	None		None	None	6 lb. 14 oz.	Cath. (1)	Good	
16653	E.N.	30	I	R.O.P.	8*	over 8	1	Full	Medium	None	Lat. epis.	None		None	None	8 lb. 10 oz.	None	Lat. cerv. tear	
16739	S.K.	23	II	occipito-sacral	5*	2	3	Full	Medium	None		None		None	None	10 lb. 10 oz.	None	Good	
16753	M.S.	35	II	R.O.P.	13*	4	1	Full	Medium	Pit. (2)	Med. epis.	None		None	None	8 lb. 1 oz.	None	Good	
16780	M.B.	30	II	O.S.	3*	1	1½	Full	Medium	None	None		Still born	None	None		None	Good	Fœtal heart not heard on admission
16884	B.L.	36	III	R.O.P.	13*	3	4	Incomplete	Medium	Pit. (1)	None	None		None	None	11 lb. 2 oz.	None	Good	Advanced cardiac
16914	F.C.	19	I	L.O.P.	15*	7	6	Full	Medium	Morph. (2)	Lat. epis.	None		None	None	8 lb.	Cath. for 48 hrs.	Good	
16968	E.J.	21	I	R.O.P.	19*	19	2	Full	Medium	Morph. (1) Pit. (1)	Med. epis.	None		None	None	6 lb. 1 oz.	None	Good	
17226	F.F.	28	II	R.O.P.	10*	8	1	Full	Low	Morph. (1)	2nd deg. tear	None		None	None	6 lb. 13 oz.	None	Good	Contracted pelvis
17995	D.G.	25	I	R.O.P.	14*	2		Incomplete	Medium	Morph. (1) Pit. (1)	1st lac	None		None	None	6 lb. 13 oz.	None	Good	
18035	E.S.	28	III	L.O.P.	16*	3	2	Full	Medium	None	None	None		None	None	7 lb. 13 oz.	None	Lac. cervix	
18192	R.K.	36	III	R.O.P.	22*		2	Full	Low	Pit. (2)	None		Still born	None		9 lb.	None	Good	Skin macerated
18220	B.S.	29	VI	R.O.P.	8*	1½	1	Full	Low	None	None	None		None	None	8 lb. 4 oz.	None	Good	
18310	T.Q.	38	III	L.O.P.	4½*	2½	2½	Full	Low	Pit. (1)	None	Abrasions on face		None	None	10 lb. 9 oz.	None	Lacerated cervix	
18392	R.R.	22	I	R.O.P.	10*	8	½	Full	Low	Pit. (2)	None	None		None	None	9 lb. 9 oz.	None	Good	
18420	A.V.	35	V	R.O.P.	15*	14	14	Full	Low	None	None	None		None	None	5 lb. 9 oz.	None	Good	
	H.M.	24	III	R.O.P.	19	4	3	Full	Medium	Pit. (1)	None	None		None	None	10 lb. 8 oz.	None	Good	
18652	S.S.	27	I	R.O.P.	12*	8	8	Full	Medium	Morph. (1)	Med. epis.	None		None	None	5 lb. 10 oz.	None	Good	
18686	R.G.	29	III	L.O.P.	8*	1½	8	Full	Medium	None	None	None		None	None	7 lb. 15 oz.	None	Good	
18973	P.S.	25	I	L.O.P.		2½	1	Full	Low	None	1st laceration	Abrasion on right cheek		None	None	8 lb. 11 oz.	None	Good	
18989	R.W.	24	I	R.O.P.		1½	1	Full	Low	Morph. (1)	Med. epis.	None		None	None	7 lb. 13 oz.	None	Good	
19012	A.C.	23	I	L.O.P.	17*	3	7	Full	Medium	Morph. (1)	Med. epis.	None		None	None	8 lb. 9 oz.	None	Good	
19029	A.B.	21	I	R.O.P.		21	5	Incomplete	Medium	Morph. (1)	2nd lac.	None		None	None	9 lb. 2 oz.	None	Good	
19040	R.J.	23	I	L.O.P.	75	8	22	Full	Low	Morph. (2) Pit. (2)	Med. epis.	None		None	None	6 lb. 8 oz.	None	Good	
[illegible]	S.S.	[illegible]	I	R.O.P.	[illegible]	[illegible]	[illegible]	Incomplete	Medium	Morph. (2)	Med. epis.	None		None	None	9 lb. 8 oz.	None	Good	
19128	A.O.	23	I	L.O.P.	51	4	2	Full	Medium	Morph. (2) Pit. (2)	Med. epis.	None		None	None	8 lb. 5 oz.	None	Good	
10343	R.H.	22	I	L.O.P.	12	6–12	8	Full	High	Pit. (1)	None	Abrasions on [illegible]		None	None	8 lb. 5 oz.	None	Good	

19040	R.J.	23	I	L.O.P.	75	8	22	Full plete	Low	Morph. (2) Pit. (2)	Med. epis.	None		None	None	2 oz. 6 lb. 8 oz.	None	Good	
19128	A.O.	23	I	L.O.P.	51	4	2	Full	Medium	Morph. (2) Pit. (2)	Med. epis.	None		None	None	9 lb. 8 oz.	None	Good	
19343	R.H.	22	I	L.O.P.	12	6–12	8	Full	High	Pit. (1)	None	Abrasions on both cheeks		None	None	8 lb. 5 oz.	None	Good	
19468	M.G.	21	I	L.O.P.	Over 72	Over 8	4	Incomplete	Medium	Morph. (2) Choral Sod. Brom. = 1	None		Still born	None	None		None	Small left lat. lac.	Meconium passing 4 hrs. before delivery. Fœtal heart sound not heard 2 hrs. before delivery
19655	R.A.	21	I	L.O.P.	21	1½	Over 1½	Full	Medium	None	Med. epis.	None		None	None	7 lb. 14 oz.	Cath. (1)	Good	
19700	R.H.	34	I	L.O.P.	28	12	3	Full	Low	Morph. (1) Pit. (2)	Lat. epis.		Still born	None	None	11 lb. 8 oz.	None	Good	Fœtal heart sound not heard 12 hrs. before delivery
19872	R.A.	37	III	R.O.P.	11	7	1	Full	Low	None	None	None		None	None	5 lb.	None	Good	
19814	D.B.	24	I	L.O.P.	30	16	2	Full	Medium	Morph. (1)	2nd deg. laceration	None		None	None	8 lb.	Cath. (11)	Good	
19851	D.D.	28	I	L.O.P.	3*	3+ Fully dilated on admission	Over 3	Full	Low	None	Med. epis.	None		None	None	6 lb. 12 oz.	Cath. (4)	Good	
19858	P.A.	23	I	L.O.P.	75	9	9	Full	High	Morph. (1) Pit. (1)	Lat. epis.	Abrasion on face		Temp. 101° for 8 da.	Temp. 101 - 6° for 2 da.	8 lb. 2 oz.	Cath. (1)	Perineum lac.	Mother's Temp. before del. 100°. Pulse 120°. Perineal wound infected.
19986	L.M.	24	II	R.O.P.	15	2	1½	Full	Low	None	None	None		None	None	8 lb. 10 oz.	None	Good	
20057	D.M.	26	I	R.O.P.	36	24+	6	Full	High	Morph. (1)	Med. epis.	None		None	None	6 lb. 11 oz.	None	Good	
20123	R.B.	25	I	L.O P.	17	17	2	Full	Low	None	Epis.	None		None	None	7 lb. 14 oz.	None	Good	
20262	R.H.	34	IV	R.O.P.	7½	12	2	Full	Medium	None	None	None		None	None	5 lb. 12 oz.	None	Good	
20312	B.S.	28	I	R.O.P.	10	2	1½	Full	Medium	None	1st deg. laceration	None		None	None	6 lb. 8 oz.	None	Good	
20231	D.F.	33	III	R.O.P.	14	2½	2	Full	Low	None	1st deg. laceration	None		None	None	7 lb. 4 oz.	None		
20301	E.Z.	25	I	R.O.P.	8	½	1	Full	Low	None	Med. epis.	None		None	None	6 lb. 6 oz.	None	Good	
20482	S.R.	24	I	L.O.P.	20	2½	2	Full	Medium	Morph. (1)	Med. epis.	None		None	None	7 lb. 11 oz.	None	Good	
	L.G.	21	I	R.O.P.	48	8	4	Full	Medium	Pit. (2)	Med. epis.	None		None	None	10 lb.	None	Good	
20488	E.M.	20	I	L.O.P.	45	55	1½	Full	Medium	Morph. (1) Pit. (1)	Med. epis.	None		None	None	6 lb. 6 oz.	None	Good	
20527	B.G.	31	II	O.S.	29	1½	½	Incomplete	High		None	None		None	None	11 lb. 3 oz.	None	Good	Head rotated. Waited for complete dil., then extracted
20617	E.N.	23	I	L.O.P.	55	Over 18	7	Full	Medium	Morph. (2) Pit. (1)	Med. epis.	None		None	None	7 lb. 9 oz.	Cath. (1)	Good	
20638	L.L.	28	II	R.O.P.	8	3	3	Full	Medium	None	None	None		None	None	7 lb. 10 oz.	None	Stellate tear of cervix	
20683	E.M.	28	III	R.O.P.	64	Over 5	2½	Full	Medium	None	None	None		None	None	8 lb. 6 oz.	None	Good	
60689	F.L.	26	I	R.O.P.	60	1	7	Full	High	Morph. (2) Pit. (1)	Med. epis.	None		None	None	7 lb. 4 oz.	Cath.	Good	
60692	B.P.	25	I	L.O.P.	54	25	2	Full	Medium	Morph. (1)	Med. epis.	None		None	None	6 lb. 10 oz.	None	Good	
20708	H.W.	30	II	R.O.P.	26	1	1	Full	Medium	Pit. (1)	None	None		None	None	7 lb. 7 oz.	None	Good	First of twins
20724	P.C.	19	I	R.O.P.	9	6	4	Full	Low	None	Med. epis	None		None	None	8 lb. 3 oz.	Cath. for 48 hrs.	Good	
20773	M.G.	27	I	L.O.P.	21½	17	5	Full	Medium	Morph. (1)	Med. epis.	None		None	None	8 lb. 5 oz.	None	Good	
	G.S.	25	II	L.O.P.	18	8	5½	Full	Medium	Pit. (2)	Med. epis.	None		None	None	10 lb.	None	Good	
20796	C.B.	22	I	L.O.P.	47½	18	5	Full	Medium	Morph. (1)	Med. epis.	None		None	None	7 lb. 7 oz.	None	Good	
20832	C.G.	22	I	R.O.P.	39	3	5	Full	Medium	Morph. (1)	Med. epis.	None		None	None	8 lb. 4 oz.	None	Good	
20854	T.T.	25	I	O S.	14	2	3	Full	Medium	Morph. (1)	Med. epis.	None		None	None	7 lb. 7 oz.	None	Good	

anæsthetist at hand. The average weight of the babies delivered was 8 pounds. The largest baby weighed 11 pounds, 8 ounces. The smallest baby weighed 5 pounds. There was no maternal mortality. There was no fœtal mortality as a result of the delivery. Five babies were born dead, but death in these cases resulted long before delivery. One of these was born macerated; in the other 4 cases the fœtal heart disappeared hours before the delivery. These were neglected cases.

The morbidity was exceptionally low. Only two cases ran a febrile course. One had a temperature of 102° F. for 13 days. This was a case of toxœmia of pregnancy with a temperature of 102° F. before the delivery. The second case ran a temperature of 101° F. for 8 days. This patient had an infected perineorrhaphy wound. The rest of the patients (58) ran a normal puerperal course and left the hospital on the tenth day postpartum.

There were no pelvic injuries sustained beyond the ordinary perineal lacerations met with in the average forceps case. There were no discernible bladder injuries; and no urinary disturbances with the exception of 10 cases that had the usual expected dysuria for a few days as a result of prolonged pressure of the head on the base of the urinary bladder.

One patient sustained a laceration of the cervix as the result of a hurried extraction of the head with a cervix incompletely dilated. It required two sutures to repair the tear. The babies fared exceptionally well. The injuries sustained by them were very slight and then only by the larger babies. They were in the form of mild abrasion of the face which healed in a day or two. There were no manifest injuries to the babies' heads. Of the 60 babies 49 had no discernible injury whatsoever. They all left the hospital with the mothers in good condition.

There was not a single instance when the "two-forceps manœuvre" failed to give the desired result.

As regards the amount of experience necessary for the successful performance of this manœuvre, I would state that the house surgeons at the Jewish Maternity Hospital, on being shown the steps and learning the principles of the operation, are able successfully to perform it with remarkable ease. This manœuvre is also admirably adapted for cases of occipitotransverse position.

In view of the safety of this operation as demonstrated by the above results, and the ease with which it is carried out I believe that the "two-forceps manœuvre" ought to be resorted to early in the second stage, that is soon after complete dilatation is effected. There is little gained by waiting until a critical stage is reached. In the present age of prophylaxis when leaders of obstetrics are enthusiastic about eliminating the second stage of labor in normal cases and advocate prophylactic forceps and episiotomy and prophylactic version, the elimination of several hours of severe, agonizing, and unproductive pains in cases of occipitoposterior positions is not only justifiable but commendable.

The policy of allowing a patient with an occipitoposterior position to labor for hours after full dilatation, in the face of intense suffering and threatening dangers, in the hope that nature may eventually effect a correction of the malposition, is to say the least inhuman and ought to be discarded in favor of the safe, comparatively easy and uniformly successful "two-forceps" operation.

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

FRANKLIN H. MARTIN, M.D. ..... Managing Editor
ALLEN B. KANAVEL, M.D. ..... Associate Editor

MARCH, 1923

INTRACRANIAL INJURIES OF INDEFINITE LOCALIZATION

SURGEONS, who frequently deal with cranial traumatisms, have learned that the problems presented differ widely and are often extremely difficult to solve, particularly in that class of cases where there is an absence of localization and no visible fracture. Such cases often cannot be diagnosed. We are uncertain as to the existence of a hæmorrhage or an œdema or basilar fracture, a compression, or a concussion, the latter which is present in the majority of instances soon disappears. The outstanding condition that chiefly concerns the surgeon is a compression. It is unimportant whether the intracranial compression is due to concussion, contusion, an œdema, a hæmorrhage or a fracture usually associated with unconsciousness. It is often impossible to determine which of these may be the more important factor or factors. One or several of these symptoms co-exist and a localization is impossible. We may, however, accept a condition of cerebral compression when it is present as a determining factor for or against surgical attack. The fate of the case will depend upon the ability of the surgeon accurately to determine approximately the amount of pressure and whether the brain will be able to withstand the amount of existing pressure and the means to be adopted for its relief.

We must not forget that brain tissue reacts to traumatism as any other tissue save for the unyielding nature of the bony cavity in which it is inclosed, consequently œdema and hæmorrhage pressing on the unyielding brain would be a greater menace than in structures in any other part of the body. A certain amount of pressure would be tolerated by displacement of the cerebrospinal fluid and cause so little pressure on the easily compressible venous circulation as to give little or no evidence and end in resolution. However, we often observe cases where compression interferes to a marked degree due to a pronounced venous engorgement usually manifested by headache and more or less mental dullness, irritability, dizziness, etc. Then we find a type that presents, almost from the beginning, unconsciousness without localizing focal symptoms, with a decreasing blood pressure and a rapid pulse. Another type presents unconsciousness immediately after the injury, with stupor, irresponsive to reflexes, slow pulse, large pupils, choked disks, and this condition is often terminal. The phases between these extremes are many.

Cases of shock, as shown by rapid pulse, low blood pressure, cold skin, large pupils, subnormal temperature, should not be operated upon. Another class, as medullary failure, which may be recognized by a rapid and irregular pulse, a low blood pressure, rapid respiration, muscular relaxation and stupor

do not come in the operative class. They may be difficult to distinguish but that is not of practical importance; both must be treated expectantly. Most of these die if they are operated upon.

This leaves for operation cases of intracranial pressure. Sometimes pressure signs are positive but quite as often they are uncertain. The usual case that calls for an operation presents immediate unconsciousness that does not clear up, choked disks, lumbar puncture that indicates increased intraspinal pressure, slow pulse, increased blood pressure; with this clinical picture delay is dangerous.

Those cases with primary consciousness which become unconscious later with any or all the above symptoms, are surgical. Spinal punctures should be used more often. Mercury manometer indicates the degrees of intraspinal pressure in cases of intracranial injury and, further, sometimes the fluid shows blood, indicating intradural hæmorrhage. In doing a spinal puncture, one should ever have in mind the possible herniation of the medulla into the foramen magnum, particularly where the spinal pressure is unusual.

An increasing experience has taught that the operation of choice is one that will give exit from the cranial cavity such fluids as are responsible for the compression, and the operation of choice is a decompression with a sacrifice of a small piece of bone. The large osteoplastic flap has given way to a relatively small loss of bone and is done after the method of Cushing by removing a disk from beneath the temporal muscle and opening the dura. This operation has proved effective and avoids, to a greater or less extent, the large postoperative brain hernias following the removal of the large plates of bone higher up. The subtemporal opening affords ample drainage in cases of œdema, and, if there is a hæmorrhage from the middle meningeal, it can be effectively dealt with.

A. F. JONAS.

APPREHENSION

ANATOLE FRANCE, in one of his delightful essays, says that fiction gives greater happiness in the world than truth. Science searches patiently for facts; the truth and nothing but the truth must be recognized. Yet truth of itself is not a fixed quantity which can be subjected to physical standards of comparison. It can be measured and weighed only in relation to a limited number of facts. What appears to be the truth under given circumstances, when subjected to scrutiny from different standpoints, may no longer represent the whole truth.

In the practice of the art of medicine scientific ideals sometimes are the cause of failure to give the patient the relief which might be afforded because the truth as seen by the physician prevents him from doing the things that would place the patient's mind at rest. The trained physician unconsciously tends to become materialistic. We admit that thoughts are the result of the function of a material organ, the brain, but because thought cannot be measured and weighed it is regarded as non-existent, and immaterial. It has been said, more or less justly, that apprehension not justified by the event is the cause of three-fourths of the sorrow and tribulation in the world. Abernathy, the greatest physician of his time in England, said that the secret of his success was in always giving the patient definite advice with a program of treatment to follow.

Surgery offers fairly measurable and definite results in specific cases. The surgeon speaks with a certain amount of dogmatism because he is dealing with material things. There are a number of patients, however, on whom

operation is performed who have, besides their surgical ailment, a nervous condition which continues after the removal of the cause; or patients on whom operation is performed secondarily for the relief of a condition which is primarily non-surgical. The patient may be relieved of his physical disease, but the surgeon sometimes fails to realize the importance of ministering to the patient's unstable mental state, by quieting his mind, or by giving him such advice as will enable him to endure more cheerfully burdens that cannot be relieved.

When a person is ill, he and those interested in him are anxious and feel that something should be done. They do not know whether the trouble is functional, self-limited, or largely the result of apprehension. It is to this human attribute, apprehension, that the popularity of patent medicine is due. The nervous, depressed person finds temporary relief in the mental stimulation which follows the use of an alcoholic patent medicine. It is with such patients that practitioners of cults and quackeries obtain their greatest advantages. With a lack of knowledge and a lack of common honesty they are yet able to quiet apprehensions. Their success obviously lies in the comfort given, and their failure in their inability to interpret correctly the facts, and to relieve patients with ailments that yield only to medical or surgical treatment.

The mental states which we designate insanity depend not so much on fixed material criteria which may be evaluated, as on the disturbed relations of the patient to his fellowmen. So-called Christian science, so far as it relieves apprehension, gives mental comfort, but to reach one's hand into the air, withdraw it, and say, "See what I have in my empty hand," requires great imagination. Christian science is beyond the comprehension of most persons. The average person requires material evidence; the Chinaman requires the wooden Buddha, the hypnotist the crystal ball. For such osteopathy is made to order. It is based on the premise that a material thing, the bony frame, is the basis of all human discomforts, physical and mental. Its greatest weakness lies in the comparison the patient can make between his own anatomy and that of others. It is through this weakness that chiropractic has stabbed osteopathy in the back. Every person knows that he has a spine, but it is behind him, and he cannot get those enlightening comparisons with the anatomy of others which are open to the osteopathy patient. The unrelieved distress which comes from functional, nervous conditions which are true to the patient, although false to the diagnostician, puts a strong argument in the hands of mercenary persons and their deluded followers who persuade state legislatures to permit chiropractors, osteopaths, and so forth, to practice.

The three greatest enemies of mankind are: tuberculosis, cancer, and the so-called neuroses. On these we need more light.

WILLIAM J. MAYO.

MASTER SURGEONS OF AMERICA

CHARLES McBURNEY

DURING the decade from 1890 to 1900—the height of his professional career—Dr. Charles McBurney held rank as one of the greatest if not the leading figure in American Surgery. His workshop, the Syms Amphitheater of the Roosevelt Hospital, planned by him and built under his direction, was at that time one of the finest surgical amphitheaters in America, and a Mecca for American as well as foreign surgeons. His work typified the highest development of aseptic surgical technique, then still in its infancy.

Dr. McBurney was born February 17, 1845, in Roxbury, now a part of Boston, Massachusetts. His father, of Scotch-Irish birth and parentage, came to this country as a boy, and followed a manufacturing and commercial career. His mother, Rosine Horton, was of New England stock, her ancestors being among the oldest families of Maine and Massachusetts.

Dr. McBurney received his preparatory education in the Roxbury Latin School, and in a private school in Boston.

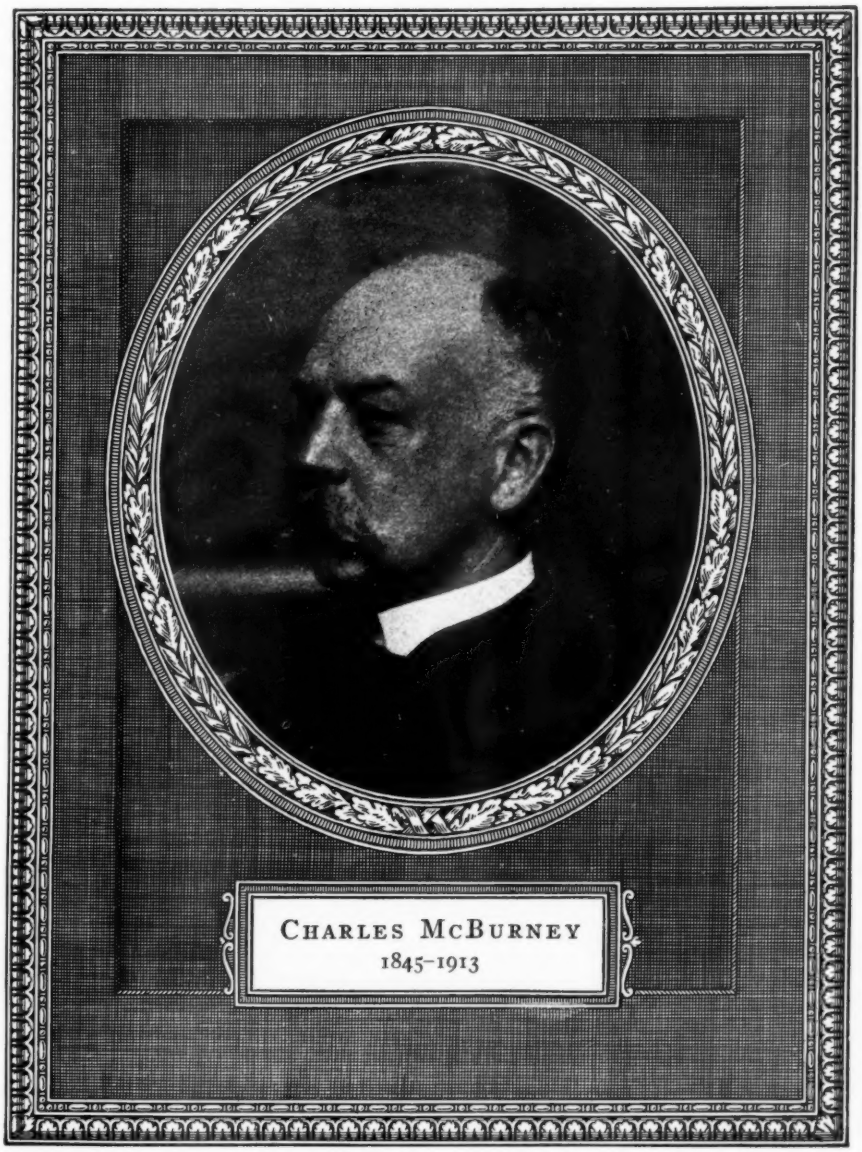
In 1862 he entered Harvard University, receiving the degree of Bachelor of Arts in 1866 and Master of Arts in 1869. In 1870 he was graduated in Medicine from the College of Physicians and Surgeons of New York.

After a surgical interneship of 18 months in Bellevue Hospital, he went abroad, pursuing his studies in surgery and surgical specialties in Vienna, Berlin, Paris, and London. In 1873 he began practice in New York, and a year later became associated with Dr. George A. Peters, a connection which lasted until Dr. Peters retired from practice 10 years later.

His teaching positions were exclusively with his alma mater, and in the period from 1873 to 1894 were successively, assistant demonstrator of anatomy under Dr. Henry B. Sands, demonstrator of anatomy, lecturer on the anatomy of nerves (1878–1880), lecturer on operative surgery (1882–1889), professor of surgery (1889–1894), professor of clinical surgery (1894–1900). He was appointed attending surgeon to St. Luke's Hospital in 1875, to Bellevue Hospital in 1880, and in 1888 as successor to Dr. Sands was placed in charge of the entire surgical service of the Roosevelt Hospital, a position which he held until 1900, and which during that period was perhaps the most notable surgical service in this country.

He held at various times the position of consulting surgeon to the New York Hospital, St. Luke's Hospital, the Presbyterian Hospital, the Hospital for Ruptured and Crippled, the Orthopedic Hospital, and St. Mark's Hospital.

He was a member of the New York Surgical Society, the New York Academy of Medicine, the Medical and Surgical Society, the Practitioners Society, and the



CHARLES MCBURNEY
1845–1913

Roman Medical Society. In Europe he held a fellowship in the Royal College of Surgeons of Edinburgh, Scotland; he was also a corresponding member of the Societe de Chirurgie of Paris and an honorary member of the Medical Society of Constantinople.

He devised several new procedures in surgical work and his contributions to surgical literature were many and important. The most notable, perhaps, were connected with the subject of appendicitis.

His paper entitled "Experience with Early Operative Interference in Cases of Disease of the Vermiform Appendix," published in the *New York Medical Journal*, December 21, 1889, in which he emphasized the importance of localized tenderness at "McBurney's point," was a classic, and a designation of the outstanding physical sign of the disease in its early stages, which will always be associated with his name, as will the intermuscular incision which he also introduced (in 1894), the "McBurney incision." In the next few years five or six other important articles on appendicitis from his pen appeared in medical journals or in surgical textbooks.

His attempt to devise an operation for the radical cure of hernia was not so successful, but was an evidence of his activity in seeking to improve the surgical procedures of his time. Other important contributions to surgical literature, some of them introducing new procedures were:

"Dislocation of the Humerus Complicated by Fracture at or near the Surgical Neck, with a New Method of Reduction," *Annals of Surgery*, April 1894; "Removal of Biliary Calculi by the Duodenal Route (a new Operation)," *Annals of Surgery*, 1898; "The Use of Rubber Gloves in Operative Surgery," *Annals of Surgery*, July, 1898; "Remarks Concerning the Practice of Aseptic Surgery," *New York Medical Journal*, March 22, 1902; "The Technique of Aseptic Surgery," *International Text Book of Surgery*.

He was one of the early and consistent advocates of the use of rubber gloves, and his teaching did much to make their adoption universal.

His increasing and extensive private practice necessitated his relinquishing the chair of surgery at the College of Physicians and Surgeons in 1894, but he continued as professor of clinical surgery until he gave up active hospital work.

He was called as consultant to the bedside of President McKinley a few days before his death.

Although a good student of his specialty, Dr. McBurney was not a scientist in the restricted use of the term, but shone by his strong common-sense in his attitude toward his patients. He could not have been called a "brilliant" operator, but his lack of hesitation, founded on the care with which he planned every operation and the thoroughness with which he completed each step before passing to the next, resulted in a great saving of time and left the spectator with the profound impression that he had seen a "Master of his Art" at work. Bold, yet a great respector of tissues, the finished result of his operations left little to be desired.

Dr. McBurney was a true sportsman and fond of out-door life. He was an expert shot and salmon fisher. All his life he took a great deal of out-of-doors exercise. During his interneship at Bellevue, he rowed almost daily on the East River in a single shell and up to the end of his life was an ardent devotee to golf.

His last years were saddened by ill health which drove him into retirement in 1905, nine years before his death.

His career marks a brilliant epoch in the development of American surgery and his name will go down to posterity as one of the strongest and ablest men, who have helped to bring it to the forefront as it stands today.

CHARLES H. PECK.

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD NOVEMBER 17, 1922, DR. HENRY F. LEWIS, PRESIDING

REPORT OF THREE CASES OF ABDOMINAL SECTION FOR UTERINE FIBROID AFTER THE USE OF RADIUM

DR. THOMAS J. WATKINS: CASE 1. Mrs. M., age 41, had a symmetrical fibroid, the size of a two and one-half months' pregnancy. The uterine canal was 4 inches deep. November 23, 1921, 900 milligram hours of radium, single screen, were given. Two menstruations followed the radium treatment; the first was scant, the second of normal amount. Amenorrhœa persisted for 8 months. Examination on February 6, 1922, showed no decrease in size; no increased hardness; November 8, 1922, patient reported menstruation in September and October which was quite free. The uterus then was about the size of a 3 months' pregnancy; the tumor more of a subserous type. November 13, 1922, abdominal section revealed a fibroid tumor, extremely soft and œdematous; ovaries, normal, one containing a recent corpus luteum.

CASE 2. Mrs. Z., age 43. The uterus was 3¼ inches deep. Patient suffered with endocervicitis, small cystocele and rectocele. Menstruations were about normal. She gave a bad hereditary history of cancer. April 28, 1922, radium, 1,800 milligram hours, was given in cervix and body of uterus. No fibroid was found. Radium was used partly for infection and partly as a prophylactic for cancer. August 1, 1922, the uterus was senile in size. November 1, 1922, recent hæmorrhage, first since radium was used. The uterus was about the size of a 2 months' pregnancy. The uterus was 3¾ inches deep; a fibroid nodule was felt with the curette. Abdominal section revealed a very soft œdematous fibroid, partly subserous, 2 to 3 inches in diameter. The ovaries were senile in appearance.

CASE 3. Miss S., age 50. Patient was very anæmic and had a cardiac valvular lesion. The uterus was the size of a 4 months' pregnancy. May 8, 1922, radium insertion, double screen, 1,500 milligram hours. Tumor was located chiefly in the anterior wall of the uterus. July 20, 1922, no decrease in size was apparent but general condition was much improved. Amenorrhœa has persisted since radium treatment. October 16, 1922: patient has had some bleeding from uterus. Abdominal section revealed a very soft œdematous fibroid making the uterus the size of 4½ months' pregnancy; ovaries are senile.

The soft œdematous fibroid is probably the result of destruction of the small blood vessels by the radium. Destruction of the veins interfered with absorption which was probably the reason why these cases required operation after using radium,—an uncommon result in our experience.

The circulatory disturbance probably caused recurrence of the bleeding in the two cases with senile ovaries. The swelling which resulted probably activated the uterus.

DISCUSSION

DR. CHARLES E. PADDOCK: If I understood Dr. Watkins correctly, he stated that he would not care to use radium on a patient under 45 years of age. What treatment would he pursue in cases of single fibroids of the size of an orange or under? Again, is it not a fact that most of his patients with fibroids were under forty-five? Is it not a fact that in most of the cases in which he has used radium the patients were under 45? I should like to know if Dr. Watkins is going to abandon that line of treatment. Again, what percentage of his cases become sterile after this treatment with radium? How long does the sterility remain? I have one case in which Dr. Watkins used radium; the woman became pregnant subsequently. Two cases in which I personally used radium became pregnant within a year.

DR. CHARLES S. BACON: I would like to ask Dr. Watkins what his objection is to using radium if bleeding returns? If it is good once, why is it not good a second time?

DR. N. SPROAT HEANEY: I thoroughly agree with Dr. Watkins in advising more conservatism in the treatment of fibroids with radium. Those who were the first enthusiastic advocates of radium in all classes of cases are now being followed by the profession at large, and trouble is produced. There is a prevalent idea that a case of fibroids can either be operated upon or treated with radium. I believe that the indications for treatment by each method are well defined.

Dr. Watkins mentioned one case where he operated upon a cystocele and rectocele and in the same patient at the same time applied radium for the treatment of fibroid. I believe that if a case is operative at all, it should be wholly operative; nothing is gained by a combination of the so-called non-operative with the operative procedure.

I believe that the cure of the fibroid is dependent upon destroying its blood supply by producing an endarteritis of the vessels supplying the fibroid nodule and that this is the primary effect of the radium in the treatment of a fibroid. A secondary effect is produced through the action of the radium upon the ovaries. I believe that the general results of treatment for fibroids with radium would be more satisfactory if, except in particular cases only, small tumors were treated.

DR. CAREY CULBERTSON: Dr. Watkins reports recalling to my mind a case that was treated with radium last winter which shows, on the other hand, the advantages of radium where the patient is not a good operative risk. This patient was a woman, 38 years of age, who came complaining of pain in the legs due to a large fibroid impacted in the pelvis, with a fairly good sized pedunculated fibroid superimposed on top of it. Under ordinary circumstances she would have been operated upon, but she had a marked nephritis, with casts of all sorts and an abundance of albumin in the urine. So I did not regard her as a good operative risk. I gave instead 72 milligrams of radium for 24 hours. She ceased menstruating. Two months later the fibroid, which had been fixed, was freely movable, and appreciably smaller in size, and the symptoms of pressure were entirely relieved. I then gave her another dose of radium of the same size, and I saw her again this fall, and she feels very comfortable now, although she still has a large fibroid. Her nephritis has not appreciably improved.

Dr. Heaney brings up an important point in treating cases that come to us for treatment by radium.

I had a patient sent to me last year from down state by a physician who had told her that I would give her radium. I had never seen her before her arrival at the hospital. She refused to have a dilatation of the cervix because the doctor had told her that she did not need to be operated upon. It took me an hour, after I had her in the operating room, to persuade her and the husband that in order to introduce radium in the uterus it would be necessary to dilate the cervix.

DR. WATKINS (closing): Forty-five years is an arbitrary age which we assume as being near the menopause. If radium is used before that age the amenorrhœa is quite liable to be only temporary, and before that age we assume it is better to remove the tumor by surgery than to injure the ovaries with radium. We have had no case of pregnancy following large doses of radium but have had following small doses in the cervix, for endocervicitis.

In reply to Dr. Bacon, we have in occasional cases repeated the radium treatment. In the cases reported above, it seemed better to operate than to repeat the treatment.

In reply to Dr. Heaney, I concur with him in what he says relative to the destruction of small blood vessels as a curative factor in radium therapy. In these cases it did not, however, act according to expectations. Like Dr. Culbertson we have had radium act well in tumors which would not be considered desirable cases for radium treatment, an experience which illustrates the fact that indications can be extended in poor surgical risks.

We frequently use radium and operate at the same time, and have had no case where the radium seemed to interfere in any way with the results of the operation.

EXHIBITION OF FIBROID WITH PREGNANT UTERUS

DR. ALBERT GOLDSPOHN: About 8 weeks ago I removed this specimen from a small maiden lady, a domestic, who came to me suffering with a large tumor. On close examination it was quite evident that she was also pregnant. She gave a history of having the usual amount of nausea in the earlier months of pregnancy. At this time she was 5 months pregnant. An odd feature in the diagnosis was that vaginal examination revealed nothing except this mass which filled the pelvis. The cervix could be reached only by inserting the fingers up above the upper border of the symphysis where a dimple of the external os could be felt. This large tumor was in the upper part of the abdomen lying to the left above the umbilical line, encroaching upon the thorax. This mass I show you is the uterus which has contracted materially, as you will see, because it contained the intact ovum, a fœtus of 5 months, which greatly crowded these masses up against the thorax.

From her history it was evident that she had become greatly disabled and was confined to bed at home in a distant state, for several weeks. It was thought that she had peritonitis, by the family doctor. She was a small creature, only 4 feet and 10 inches high. She weighed usually 110 to 115 pounds. The abdomen was greatly distended, respiration difficult.

I had Dr. Bacon examine the case in consultation before treatment. Every one who examined her was impressed with the necessity of operating on her. No one thought it would be better or safe to wait another 3 months, for a viable child, for that would have created such a deplorable condition in that woman that she would not have been able to withstand the necessary cæsarean section with the removal of the tumor also. I had an idea that if cæsarean section only were done in the presence of the fibroids, there would be serious difficulty in stopping the hæmorrhage, so that it would result only in a very bad prognosis. I therefore decided that operation should be done as soon as the patient could be gotten into a little better condition.

The surgical treatment of the case went smoothly and everything healed finely; but about one week after operation the patient began to have delusions which at times improved a little, but in the course of 4 weeks, while we had her under our care, these delusions became more and more fixed, so that we

were obliged to transfer her to the Psychopathic Hospital.

You will notice in the larger tumor a very considerable breaking down of the fibroid; and there were extensive recent adhesions throughout the upper part of the mass showing that peritonitis really had been active there, as a result of rupture of degenerated foci near the diaphragm.

DISCUSSION

DR. THOMAS J. WATKINS: I presume from what Dr. Goldspohn has said that his patient could not well have been left to go to term and be relieved by Porro operation. As a general proposition, in cases of fibroid tumors with pregnancy, I believe that they should almost invariably be allowed to go to term and be delivered by cæsarean, followed by excision of the fibroid uterus. Results have demonstrated that the recoveries are smoother after a Porro than a cæsarean operation, and the supravaginal hysterectomy is not made more difficult by the pregnancy if the circulation is carefully controlled by clamp forceps before incising.

DR. CHARLES S. BACON: There were one or two features about this case of Dr. Goldspohn's that were not mentioned by him that might be brought up. The fact that the child was illegitimate is one, and another is that the woman was of very low mentality. Nevertheless, if the child were legitimate and the woman was anxious for a child, I do not believe it would have been the wise thing for her to carry the child until it was viable considering the condition she was in. I understand she had some kidney involvement.

DR. GOLDSPOHN (closing): Yes, she had albumin in the urine. I do not think that if any of you gentlemen had examined this patient and had seen the condition she was you in, would question the procedure I resorted to in this case. The child was illegitimate, and she tried to deny it. I do not believe that she knew what was the matter with her. She had been seen by other physicians, who recognized a tumor with peritonitis, and recommended operation. The man who is responsible, instead of taking that advice, brought her to this city and deserted her in a railway station, with the advice to inquire for and to find the County Hospital. Even if the conditions had been more favorable, and if she had known she was pregnant and desired to have a child, I doubt whether it would have been sound judgment to have entered upon such a venture in this case.

DR. CHARLES E. PADDOCK: There was no doubt that the operation was indicated, but why lay such great stress upon the fact that the case was an illegitimate one? There were good reasons for operating but because the unborn child was illegitimate was not one of them.

BIRTH CONTROL AND STERILITY

DR. C. HENRY DAVIS, Milwaukee, Wisconsin: A childless marriage may be a happy one but is never the happiest. There are very few normal women who do not desire a home and children. This is equally true of men. We are, therefore, justified in assuming that some form of sterility is as a rule responsible when a union continues childless over a period of 5 or more years. Too often friends and relatives add to the secret sorrow by chiding the unfortunate couple for not wanting children or using "birth control."

Conception is dependent on the following conditions:

1. The deposit of living, active spermatozoa in the upper portion of the vagina;
2. The passage of active spermatozoa through the cervical canal and uterine cavity into the fallopian tube;
3. The passage of a healthy ovum from the ovary through the tube at a time when active spermatozoa are present;
4. The fertilized egg must find a resting place where it can develop until the period of viability.

All four conditions must be fulfilled. It is evident, therefore, that the sterility may be due to faults of either husband or wife and no examination is complete which does not include a microscopic test of the semen. The husband may have active spermatozoa and yet be responsible for the sterility. Latent gonorrhœa in the male may cause a low-grade infection in the woman with permanent closure of the tubes. Findley states that one marriage in ten is non-productive and that in at least one-sixth of these the man is sterile.

In the study of sterility cases I have long been impressed with the factor of birth control in causing many functional cases and gradually have come to believe with Dr. Englemann, "that the avoidance or the prevention of conception if possible, the premature termination of pregnancy if need be, are factors far more potential of causation of decreasing fecundity than is the progress of genetic science to the contrary." The subject "Birth Control and Sterility" therefore seems a fitting one for discussion. Dr. Child, in his monograph on "Sterility and Conception," considers "all of the artifices that are used for the prevention of conception or the limitation of offspring injurious alike to morals and to physical health." He quotes the following from Dr. Goodell:

"The sexual instinct has been given to man for the perpetuation of his species: but, in order to refine this gift and to set limits to its abuse, it has been wisely ordered that a purely inellectual quality—that of love—should find its most passionate expression in the gratification of this instinct. Dissociate the one from the other, and man sinks below the level of the brute. Destroy the reciprocity of the union, and marriage is no longer an equal partnership, but a sensual usurpation on the one side and a loathing submission on the other; wedlock lapses into licentiousness; the wife is degraded into a mistress; love and affection change into aversion and hate."

Birth control may be practiced without danger of conception when one or both parties are actually or potentially sterile. If both parties are virile sooner or later there is a mishap and pregnancy results. Those who merely aimed to postpone the pregnancy accept this with good grace—but all too often the woman is rushed to the abortionist while still in the hysterical stage and her life and future health jeopardized.

Birth control to be at all effective demands a considerable degree of intelligence and self-control. By virtue of this fact it can be of little value to the class of people for whom the enthusiasts, like Mrs. Sanger, say it is intended. The more highly educated woman usually marries after twenty-five when she has already passed the period of greatest fertility. If she then uses contraceptives for a few years she often becomes potentially sterile and medical treatment may be required before a pregnancy will result. Furthermore, in many instances, the unnatural sexual practices have made her more or less neurotic. These cases are apt to end in a sanatorium or a divorce court.

In the study and treatment of sterility cases I have endeavored to utilize the suggestions made by Reynolds, Child, Watkins, Rubin, and others who have written on the subject. However, in this paper no attempt will be made to detail treatment or discuss the merits of various procedures. The following general plan is the one I have used during the past 3 years in treating women who complain of sterility:

1. A carefully taken history is important;
2. A thorough physical examination with special attention to pelvic organs is needed;
3. Test spermatozoa, having the woman come to the office immediately after intercourse;
4. If the pelvic examination is negative and the spermatozoa active the woman is placed on medical treatment. Intercourse is permitted at not less than 3-day intervals during the 2 weeks following menstruation and none during the balance of the month;
5. If a pregnancy does not result within a few months she is advised to have an inflation test to determine the patency of the tubes;
6. Surgical treatment is advised where pathology demands, but rarely with much hope of relieving the sterility;

The advice given patients, the nature of treatment and end-results may best be given by briefly reviewing a few typical cases:

Case 1. Mrs. B., age 38, was very anxious to have a baby, but she gave a history of an induced abortion at age 20, a spontaneous one at 24 and a second criminal abortion when 28; this was followed by contraceptive methods. Examination showed tubal involvement on both sides. The semen test was normal. Tubal inflation was not advised in this case. She has pelvic pathology and eventually will require surgical treatment.

Case 2. Mrs. J., age 28, complained of amenorrhœa of 1 year's duration and sterility. Five months after marriage she stopped menstruating without becoming pregnant. Examination of pelvis was negative but she presented a typical picture of pituitary dysfunction. She was given thyroid extract 2.5 grains, 2½ t.i.d. and 1 tablet ovarian extract t.i.d. starting May 6, 1921. She menstruated in June and July. July 22 she was given calcium lactate 10 grains daily. There was no flow in August and September 26 a diagnosis of early pregnancy was made. May 18, 1922, she was delivered of a healthy female baby.

Case 3. Mrs. H., age 27, had been married nearly 4 years and had taken no precaution against pregnancy after the first year. Examination showed normal pelvic organs with the exception of a chronic cervicitis and endocervicitis. After 3 months of local treatments this condition was relieved, and the spermatozoa were found active 30 minutes after intercourse. With a sterile applicator, seminal fluid was passed from vaginal vault into the upper portion of the cervix. She missed the next period. At 2½ months she miscarried. Four months later she again became pregnant and August 22, 1922, was delivered of a husky boy.

Case 4. Mrs. A., age 22, married 1½ years, gave a history of precaution during first year, but none since. She has never reacted with intercourse. Examination showed normal genitalia. She was given ovarian extract t.i.d., and a few local treatments to clear up a slight cervicitis. The husband was given instruction regarding intercourse. She became pregnant following the next period.

Case 5. Mrs. P., age 23, had three miscarriages, due in part at least to a retroflexion of the congenital type. I shortened the round ligaments by the Webster-Baldy method and the uterosacrals by sewing to back of the cervix. Eight months later she became pregnant and was delivered of a healthy boy at term. The uterus has remained in good position since the delivery.

Case 6. Mrs. J., age 21, married 2 years and has used no precaution since the first year. The uterus was retroposed but otherwise normal. She was instructed to limit intercourse to the first two weeks after a period. Calcium lactate, 5 grains, was administered twice daily and ovarian extract t.i.d. She had one more period and is now nearing term.

Case 7. Mrs. H., age 26, gave a history of precaution during the first 2 years of married life but none for nearly a year. Examination showed the uterus to be of the infantile type and retroposed. The ovaries were small. She was given ovarian extract t.i.d. and instruction regarding intercourse. After three more periods she became pregnant and at term was delivered of a healthy boy.

Case 8. Mrs. E., age 22, married 16 months, complained that intercourse was impossible. Examination showed a rigid hymen with small opening. She menstruated only once after the hymen was dilated and in due time was delivered of a healthy girl.

Case 9. Mrs. K., age 27, first seen following

criminal abortion which was incomplete. Curettage was necessary owing to hæmorrhage. This was followed by temperature for over 2 weeks. This was her second criminal abortion. She is now very anxious to have children but has remained sterile for over 3 years.

CASE 10. Mrs. W., age 28, married 2 years, had used no precaution and had taken treatments for sterility. Examination of the semen on four occasions showed no spermatozoa. The husband had an epididymitis before marriage and is sterile.

CASE 11. Mrs. L., age 29, married 1 year, had never taken precautions. Examination showed enlargement and tenderness of both adnexa. Spermatozoa were active and husband denied gonorrhœa. In the tubal inflation test some gas passed at 100 millimeters, but only under high pressure. Six months after this test she developed acute pelvic symptoms and subtotal panhysterectomy was necessary because of bilateral pyosalpinx. Cultures were negative and the sections showed that it was due to tuberculosis.

Many more cases might be cited with their individual variations in findings and treatment. I have had several girls who had never menstruated because of congenital defects and they, of course, will never become pregnant. In other cases the women had closed tubes due to gonorrhœa contracted before marriage or later from the husband. In a few cases hæmatogenous infections had caused closure of the tubes and thereby permanent sterility. A few men due to excessive intercourse were functionally sterile as the spermatozoa were immature and weak. On the other hand I have had within the year at least ten women who became pregnant while using "birth control precautions." Therefore, I have come to the following conclusions:

1. A long-continued prevention of conception is possible when one or both parties are sterile or potentially sterile;

2. If both parties are virile soon or later a pregnancy will result in spite of contraceptives;

3. The use of contraceptives tends to produce a functional sterility;

4. A criminal abortion is apt to result in a permanent sterility;

5. The average girl of today leads a life which tends to reduce her fertility. She will have a relatively small family even though no precautions are used, and attempts to postpone pregnancy may result in her having no children;

6. The advocates of legalized "birth control" are a menace to civilization. Sterilization is the only thing which will stop the reproduction of the subnormal and unfit. Practiced clandestinely, birth control does much harm and little good; if legalized, it would in a few generations destroy our civilization and leave a race of degenerates;

7. Functional sterility can usually be corrected if both husband and wife will co-operate with the physician and continue treatment for a sufficiently long period.

DISCUSSION

DR. RACHELLE S. YARROS: I am glad that Dr. Davis has brought this subject before your society for discussion. I am sure you all realize fully that birth control is a fact and not a theory; that it has been and is being practiced in all civilized communities. The question really is as to methods and as to who should supply the information. Shall we leave it to the public to continue to gather scraps of information regarding methods of contraception, with a large proportion of failures and with the danger of using injurious methods and frequently resorting in desperation to abortions, or shall we doctors learn all the modern methods and intelligently advise contraceptives in appropriate cases?

In the United States physicians, other professional people, as well as people generally of culture and refinement, usually have small families. This is not a mere accident. Most of them do not believe in sex relations for procreation only; consequently they are practicing birth control, apparently without that detriment to health, character or danger to civilization which Dr. Davis fears.

In France, Holland, and England, where methods of contraception have been better understood and practiced, we have no evidence of any deterioration resulting from birth control. The French and Holland peasants have had to practice birth control for economic reasons.

I have numerous cases that disprove the statement that when people once begin to use contraceptives they are not likely to have children except by accident. I can quote case after case among the poor, as well as among the educated and well-to-do families, who either for reasons of their own or upon my advice used contraceptives for years and then deliberately decided to have children, and in most cases they had them without difficulty.

DR. RUDOLPH W. HOLMES: I would like to call attention to the fact that Dr. Davis' first premise is not absolutely indispensable, namely, that semen must be deposited in the vaginal vault. I have done a cæsarean section twice on a woman who never has had coitus completa on account of such extreme distortion of the rami and sacrum that the vagina would not admit a finger. Similar instances are on record.

I believe our federal and state laws are wrong in making it a penal offense to use contraceptives, or even to suggest their use. However, contraceptives may be bought or sold, but as in the case of abortion they are classed as criminal procedures.

There are times when it is absolutely necessary to prevent conception, as in the case of heart disease, tuberculosis, kidney disease, general malnutrition, chronic invalidism. In aggravated cases of such it is a serious menace to the woman to bear children. It is a poor policy to advocate that the poor woman should bear a child yearly—such begets poor quality of manhood and womanhood. It is infinitely better to bring one or two children up well than a large brood poorly.

In spite of the law, people are using contraceptives, and the sentiment against their prohibition is so strong that they will continue to be used. There is a wrong and a right method of prevention; the former should be discountenanced.

DR. WILLIAM C. DANFORTH: In our discussion of this subject I think it is important to determine the male function. The physician should have samples of semen for examination.

Dr. Davis quoted Dr. Findley as saying that one-sixth of sterile marriages are chargeable to the male partner. In my own experience the percentage runs quite decidedly over that; I should say at least one-third in the cases which have come under my observation presented specimens of semen which were quite decidedly deficient, the sperm being absent or non-motile. Of course in these cases one should not operate on the woman. We find a relative sterility in men, particularly in large cities where we are dealing with men who live under high tension, who work long hours under considerable mental strain. These may acquire a functional sterility.

After the last epidemic of influenza I saw three women, whose husbands had had influenza, but no venereal infection, in all of whom there was functional sterility. There were sperms present, but perfectly non-motile. Where the woman is well, and the trouble lies with the man, it is a difficult problem. I have sent these individuals to genito-urinary specialists for treatment with little result. Sometimes an internist may help by improving the general condition of health.

It is said that if these individuals live out of doors for several months, they may recover, and instances have been reported of recovery.

DR. JOSEPH L. BAER: I venture to make two concrete assertions: First, that in Chicago today probably the overwhelming majority of all married women is using some form of prevention of conception by a single or a combination of contraceptive methods. When they fail, they drift in very considerable numbers to the professional abortionists; and second, there is on record in Chicago today a list of some four hundred physicians and midwives known to be doing criminal abortions. Women of the well-to-do and middle classes have the advantage of scientific instruction in prevention and employ the services of the so-called better abortionists, whereas women of the destitute strata are confronted with the same predicament, are poorly informed as to prevention and have access only to abortionists whose intervention often means death. There is no doubt that we should terminate pregnancy in a well-standardized list of conditions mentioned by Dr. Holmes. Yet we look on while abortions are being reported with increasing frequency in the newspapers, many of them leading to death more surely than the list of diseases for which we not only terminate pregnancy, but do not hesitate to instruct these women in the prevention of conception.

I feel quite differently than does Dr. Davis as to the possibility of functional sterility brought about by the use of proper contraceptive methods. Absolute continence, while it is conceivable, is hardly practicable. The sex instinct is next to the hunger instinct the strongest with which the human race is endowed. Continence, except at certain times a month, is a failure in the prevention of conception, as is the method employed by the great mass of the poor, the so-called withdrawal method, since the husband cannot control his seminal emission completely. Besides, there is no doubt among students of sex psychology that this particular practice, which is so widespread, is directly harmful to both partners. I believe that mechanical devices applied to the cervix are harmful. The so-called occlusion pessary with a circular ring, with rubber hood, which shuts off the external os, and which is left in position weeks at a time, is a source of direct infection to the cervical canal, such as a staphylococcus infection, which can lead to an ascending infection of the genitalia, involving the tubes, and possibly likewise involving the husband, he acquiring a non-specific urethral infection.

I believe there are safe and harmless methods of contraception, and that birth control should better be known as the regulation of conception, and the regulation of it in two directions: first, the limitation of conception among the destitute, the debilitated and the defectives, and the encouragement of conception among all those families that are qualified to raise more than one or two children, to which the average American family is dwindling. It is known on the continent of Europe as the American family, the two child family.

I think the members of this society should consider seriously whether it is not our mission, after we have reached a more or less unanimous conclusion, to take the lead in educating the public.

Among the poor at the Michael Reese Dispensary we have met this problem and have solved it in the following way: For a number of years the clinic nurse taught methods of prevention to women with increasing families. In recent times, after the social service branch of our work became established, we had relied on the social service workers to select the cases in which limitation should be taught, and these wives and husbands are brought to us for instruction.

DR. CHARLES B. REED: I am stimulated by the remarks made by Dr. Yarros to report the case of a woman who had been running a temperature of 103 to 104 for 3 or 4 days. In her case a diagnosis of influenza was made. This was last spring. I saw her in consultation and on examination I found a very tender cervix. There was a mass which could be felt in the pelvis. It was learned that a pessary had been in place 10 days. The woman had been married 4 months. She was removed to the hospital. We made some blood tests, and found the blood filled with streptococci. I think this case very clearly illustrates the danger of the use of contraceptive pessaries.

DR. CAREY CULBERTSON: I think the great difficulty in discussing any sociologic questions, such as the regulation of conception and the modification of birth control is that as human beings we are not wise enough to solve such a problem for the human race. As long as there are so many people who cannot be taught asepsis, we cannot avoid the morbidity resulting from contraception. Each one may be able to solve such a problem for himself but it is quite another thing to do this for another. In Dr. Davis' paper the influence of abortion in the production of infection is a point which should be emphasized. We know that in a large majority of cases conditions are neglected willfully or through ignorance by the patients. They go a number of days or 2 weeks with irregular bleeding, with portions of the gestation sac remaining in the uterus, and such a condition is very often followed by low-grade infection sufficient to produce the so-called catarrhal inflammatory reactions in the tubes with resultant occlusion.

DR. DAVIS (closing): My interest in the so-called "birth control movement" began about 8 years ago when Dr. Blount and Yarros expressed their views at a medical meeting in Oak Park. Since then I have followed rather closely the possibilities for good or harm in the use of contraceptives and have come to the conclusions stated in the paper.

The term "birth control" is very misleading. It rarely happens that people can have a baby according to schedule. Nor can I agree with Dr. Yarros in the effectiveness of preventive methods even in the hands of highly intelligent people unless there is a potential sterility. We must consider abortion as a logical part of the birth control movement since a large part of criminal abortions are performed after the failure of contraceptives or what people thought safe measures.

Dr. Holmes has quite properly qualified my statement regarding the deposit of semen in the vault of the vagina. However, the exceptions are rare.

Dr. Danforth's question regarding "weak spermatozoa" brings up an interesting problem. It is a case of determining and if possible correcting the cause. In several cases studied it was due to excessive intercourse. I recall a patient seen with Dr. Culbertson who stated she and her husband were so anxious for children that they had intercourse at least twice every night. Some men may be potentially sterile from overwork, sedentary habits, etc. Absolute restriction of intercourse with an increase of physical exercise is of great value. Gland therapy may be of value in some cases. Dr. Danforth misunderstood my statement regarding uterine displacements; I agree with him.

Could Dr. Baer check up on all the cases given advice regarding contraceptive methods I am certain he would find that a goodly number had become pregnant while using contraceptives. If there are economic reasons why young people can not consider pregnancy it is better to postpone marriage than resort to contraceptives. As physicians we should give our patients to understand that when a pregnancy occurs, they must accept it rather than rush to the abortionist as so many do today.

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS ON SURGERY

THERE is in these two small volumes[1] an old English flavor, so insinuating and pervasive, that one is prompted to exclaim, "Ods bodikins! A jolly brace of books." As a matter of fact, however, notice is paid to them in this review department, not because of their flavor but rather because we feel that the reading of them will furnish to any physician of appreciation, a real joy. They are not medical history in the conventional, dry-as-dust sense; rather do they give a vivid pen picture of medicine and surgery in England during the 15th century, as expounded by the master, John Arderne, and in the 17th century by that leader of English medicine, Thomas Sydenham.

The Sydenham volume is done by Dr. John D. Comrie of the University of Edinburgh, who contributes a short, thirty-page biography, with an appended, very full bibliography of Sydenham's life and works, followed by about one hundred pages of abstracts from the selected writings of Sydenham. These abstracts embrace about one-third of all of Sydenham's writings, and they are presented with that fine sense of discrimination that characterizes so much of the literary work of the English clinicians. When one has finished reading these abstracts, he has a most satisfactorily comprehensive idea of Sydenham's views on gout, epidemic diseases up to 1679, venereal disease, hysterical affections, small pox and St. Vitus dance.

Sir D'Arcy Power has handled his material in totally different fashion. In a short preface, he furnishes what little is known concerning Master John Arderne, surgeon of the 14th century. He shows wherein and why he was a practical surgeon, and reproduces an attractively charming colored print picture of old master John copied from a 15th century manuscript. All this is done within the compass of a dozen pages, after which there follows a literal translation (Master John wrote in Latin) of Arderne's manuscript—a scroll 17 feet long, by 15 inches wide, made up of twelve skins of vellum, sewed together. The manuscript is written in three columns, and is abundantly illustrated by colored pictures, quaint, artistic, and some of them humorous. D'Arcy Power has reproduced much of the manuscript, in thirteen full-sized plates, and has further enlivened his translation by explanatory foot notes.

Personally, I wouldn't barter the pleasure of having read Sydenham's "Gout" for the knowledge gained from a half dozen of our best modern textbooks, and I'd rather own old Master John, than to be the possessor of the rarest old rug from Araby.

One is struck by the childlike, utterly primitive thought of Arderne as contrasted with the strikingly logical reasoning of Sydenham (after all, however, the years of 1600 aren't so far back of us), and yet Arderne handles the subject of fistula-in-ano in very up-to-date fashion, whereas Sydenham exploits the "methodus medendi morbos per accubitum junioris," which is none other than a recommendation to cure great debility in old folks by putting young and vigorous persons in bed with them. He cites a cure that he wrought in the instance of a very sick old lady, by putting a 13-year-old girl "close to her breast."

If it were not that our cherished Anglo-Saxon culture teaches us repression, we might constitute ourself a cheer leader, and with appropriate gestures, shout: "Now, fellows, all together—John Arderne and Thomas Sydenham!" M. G. SEELIG.

THIS monograph[2] is one of that small group of clearly and concisely written books which stand apart by themselves. From a practical viewpoint, its subject matter thoroughly covers the surgery of the peripheral nerves and the book should be of material aid to the general surgeon called upon to deal with an occasional case of peripheral nerve injury.

The anatomy of the peripheral nerves, rather briefly considered, to be sure; the diagnosis of nerve lesions; the indications for operative interference; the type of operation to be chosen; prognosis and after-treatment constitute the first part of the volume. The second portion of the theme takes up in detail the surgical anatomy and methods of exposure of each of the peripheral nerves most commonly exposed to injury. In addition, a short discussion of the various methods of effecting union when end-to-end apposition cannot be obtained is given. Part three considers in detail the various tendon transplantations which may be used in the event of failure to obtain functional nerve regeneration.

The presence of supplementary movements in the muscles of both extremities is a point the impor-

[1] SELECTED WORKS OF SYDENHAM, by John D. Comrie, and DeArte PHISICALI ET DE CIRURGIA OF MASTER JOHN ARDERNE, Surgeon of Newark, Dated 1412, by Sir D'Arcy Power. New York: William Wood & Co., 1922.

[2] TREATMENT OF INJURIES OF THE PERIPHERAL SPINAL NERVES. By Sir Harold Stiles, K.B.E., F.R.C.S. (Edin.), and M. F. Forrester-Brown, M.S., M.D. (Lond.). New York: Oxford University Press, 1922.

tance of which cannot be overemphasized from the standpoint of diagnosis of nerve lesions. The authors very carefully describe the fixation of neighboring joints and the transposition of the nerve trunks from their normal bed to more favorable locations in efforts to obtain an end-to-end anastamosis.

LOYAL E. DAVIS.

IN this monograph the authors[1] have considered all of the anatomical lesions, congenital or acquired, inflammatory or non-inflammatory which frequently are present about the cæcum and proximal colon. While many of these conditions may be present in a quiescent stage for a considerable period of time, they closely resemble certain valvular cardiac lesions in a stage of compensation. At any given moment the equilibrium may become broken and clinical symptoms become appreciable.

Pain in the right lower abdominal quadrant does not always justify casting suspicions upon the appendix which eventually lead to its removal. Other visceral lesions existing alone or associated with appendiceal inflammation may provoke similar and persistent symptoms. Patients complaining of right lower abdominal pain may be classified as belonging to one of three groups. A proportion of patients may be classed as suffering from chronic or subacute appendicitis and are unmistakably cured by an appendectomy. A certain number of others suffer from visceral or perivisceral lesions other than the appendix. In such cases, an appendectomy fails to restore the normal physiological function. To the last group belong those who have an inflammatory lesion of the appendix in conjunction with lesions elsewhere in the vicinity of the cæcum either of a developmental or acquired character. Appendectomy under these conditions must be accompanied by further operative work.

Among the extra-appendiceal lesions considered which confuse the picture are Jackson's membrane, abnormally mobile cæcum, total ptosis of the cæcum and ascending colon, ptosis and angulation of the transverse colon, cholecystitis, salpingitis, simple spasm of the ileum, and ileocæcal tuberculosis. Case examples of each of these types of lesion are included in the text. The volume deals quite thoroughly with the anatomy, embryology, recognition, differential diagnosis, and treatment of these lesions giving rise to gastro-intestinal tract symptoms resembling appendicitis. The theme is illustrative of the present trend toward surgical restoration of physiological function.

LOYAL E. DAVIS.

WHILE the subject of fractures is world old, it still arises perennially, both in society discussions and as the output of the interested author via the medical publisher. This recent second issue[2] of a text on fractures of the extremities has been considerably enlarged and now contains over 600 pages with more than 150 new illustrations.

The author claims a desire to apply fracture lessons of the world war to our treatment of civil fractures, with an effort to avoid confusing the reader by too many details. An opening page devoted to the diagnosis of fracture is followed by a general exposition on treatment. Rules for X-ray examination are given along with indications for massage, electricity, and the use of anæsthesia. We are gratified to note an acknowledgment of worth of the Thomas splint, the use of which is advocated and the presence of which is called desirable in the armamentarium of every physician.

The text then takes up extremity fractures, starting with the clavicle and scapula; arm, forearm, wrist, hand, thigh, patella, leg, and foot follow. Couteaud's position for clavicular fracture, though well-illustrated, has not enough stress laid on its efficiency. The author still clings to non-operative treatment of fracture of the patella. His discussion of carpal fractures seems incomplete, inasmuch as his countrymen have done such clever research in this connection.

Plaster-of-Paris splints and encasements seem to express Judet's idea of sound basic treatment, and although continuous traction is described, most of the illustrations are confined to old-fashioned plaster treatment. Some of the apparatus pictured seems impossible of successful application; at least its maintenance until bone healing was ended would be impractical. Three very short chapters on callus formation, tetanus and gas gangrene terminate the volume.

In general one is struck by the terseness of the text, its specific information and the good classification of the injuries of each bone. Much attention is paid to the fractures of childhood, information about which is too frequently lacking in textbooks. There is a strange mixture of illustrations, varying from excellent halftones to crude line drawings. It is perhaps to be regretted in a subject so universal as fractures that with the exception of a few German references the author has not availed himself of the literature of countries other than his own.

KELLOGG SPEED.

THIS book[3] is essentially a record of personal experience in 31 cases of abscess of the brain. In addition, the author has compiled and analyzed the post-mortem records of 125 cases of cerebellar and 145 cases of frontal lobe abscess. From this material the treatment of brain abscess has been considered upon the basis of the existing surgical pathology.

Depending upon the mode of entry into the brain of different pathological processes causing brain abscess, the terms "adjacent" or secondary and "intercurrent" or tertiary are used. Emphasis is placed upon the fact that from various foci, abscesses

[1] LES FAUSSES APPENDICITES. By Th. de Martel and Edouard Antoine. Paris: Masson et Cie, 1922.

[2] TRAITÉ DES FRACTURES DES MEMBRES EXAMEN CLINIQUE, RADIOGRAPHIE, TRAITEMENTS PRATIQUES. By Dr. Henri Judet, 2d ed. Paris: L'Expansion Scientifique Française, 1922.

[3] BRAIN ABSCESS, ITS SURGICAL PATHOLOGY AND OPERATIVE TECHNIQUE. By Wells P. Eagleton, M.D. New York: The Macmillan Company, 1922.

develop in definite locations and, given these pathological facts, the surgeon should plan his operation accordingly. The author believes it possible to diagnose the presence or absence of an abscess capsule by careful evaluation of the symptoms. The diagnosis of the location of the abscess is written from the standpoint of where the pathology should be with a given mode of entry rather than from the viewpoint of the presence or absence of neurological symptoms produced by the lesion.

The volume impresses one as representing the efforts of a conscientious surgeon to treat, scientifically and successfully, the pathology of brain abscess and to pass on his experiences, good or bad, that this aspect of cerebral surgery might progress.

LOYAL E. DAVIS.

THIS little book[1] consists essentially in a table giving the dosage and other data of value in various types amenable to X-ray treatment. It is very concise and should be of value to those doing deep X-ray therapy.

A. B. K.

THE book[2] is evidently designed to meet the need of the post-graduate student of ophthalmology. It presents a clear and concise account of the regional anatomy of the orbit and eyeball with frequent references to the functional significance of the various parts. Here and there attention is called to the practical importance, for the ophthalmologist, of certain structural arrangements. On the whole, the book is well suited to meet the requirements of any one who is looking toward ophthalmology as a specialty.

The usefulness of the book could have been increased, however, if even more attention had been given to functional and practical considerations. The reader misses, for instance, any account of the filtration angle of the iris or any statement of the importance of the spaces of Fontana for the escape of fluid from the eyeball. The importance of the anastomosis between the anterior ciliary arteries and the greater arterial circle of the iris in the production of the circumcorneal injection in intraocular inflammation is not mentioned.

The anatomical facts are, on the whole, correctly presented, but occasionally the author slips on some technical point, as when he defines a synapse as the close approximation of the dendrons of one element with the dendrons or cell body of another element.

S. W. RANSON.

THE advancement made in the past decade in surgery of the respiratory tract is exceedingly striking. One has but to glance over the pages of any textbook on general surgery to note that the proper procedure for the removal of a foreign body in the trachea or bronchi is tracheotomy and extraction. With the advent of the bronchoscope and its use in skillful hands, direct examination of the larynx, trachea, and bronchi becomes more frequent.

Following the extraction of foreign bodies from the trachea, and bronchi through the bronchoscope came a study of the bronchi, and extraction of foreign bodies deeply seated in the lung and even in the upper bronchi.

Probably no one man has done more not only to perfect the bronchoscope and its accessory instruments, but also to elaborate a sure and delicate technique for bronchoscopy, than Jackson. The author, in a comparatively small volume,[3] attempts in a rather unique way to give the reader a conception of this apparently very complicated and delicate procedure. He has further chosen to make his text appealing to the reader by having it prepared more or less by a reader. He describes the instrumentarium in some detail, then follows the discussion of the peculiar anatomy of the larynx, trachea and bronchi, not only from a strictly anatomical standpoint, but from a bronchoscopic standpoint. In succeeding chapters the technique of introducing the laryngoscope and bronchoscope and the œsophagoscope is described, the author laying special stress on the fact that when the instrument is carefully and properly introduced, there should be but a slight element of danger, but he very plainly points out that if the technique is not strictly adhered to, not only great harm but even fatality may result.

The chapter devoted to removal of foreign bodies is probably the most interesting in the entire text. It is such a revelation to be told that foreign bodies of practically every description that have entered the respiratory passages, lodged in the larynx, trachea, larger bronchi, or even smaller bronchi, can be removed with comparatively little danger in practically every instance, and one has but to go over the careful technique advocated by the author to feel certain that if one prepares himself sufficiently in this technique, these rather spectacular results can be accomplished.

It would appear to the reviewer that bronchoscopy and extraction of foreign bodies from the respiratory passages has found a far greater field of usefulness than has œsophagoscopy. It is very plain to see that foreign bodies can be removed from the œsophagus and lesions of the œsophagus may be studied through the œsophagoscope, but this condition arises infrequently as compared to the study of the respiratory passages, so much so that it is a great question as to whether the œsophagoscope or gastroscope will ever come into the extensive usage of the bronchoscope.

This volume, although comparatively brief, gives a very comprehensive review of the subject, and even to the professional man who never expects to attempt such a procedure, the book is invaluable. One has but to glance at the chapter on foreign bodies in the lung to realize the peculiar symptomat-

[1] DOSIERUNGSTABELLE FUER DIE ROENTGENTHERAPIE. By Dr. G. Holzknecht. Leipzig and Vienna: Franz Deutike, 1922.

[2] THE ANATOMY OF THE HUMAN EYE AND ORBIT. By William W. Goldnamer, M.D. Chicago: The Professional Press, 1922.

[3] BRONCHOSCOPY AND ŒSOPHAGOSCOPY. By Chevalier Jackson, M.D., F.A.C.S., Philadelphia and London: W. B. Saunders Company, 1922.

ology found in these cases. Many of them are confused with embolic lung abscesses and tuberculosis. The information gained in reading this volume will not only enlighten one as to what is possible in a case of foreign body in the lung, but will widen one's vision in many instances in diagnoses of lung conditions.

This book can be heartily recommended as a unique and very valuable addition to one's library.

JOHN A. WOLFER.

ONE is comparatively safe in stating that no condition in the realm of orthopedic surgery presents more difficulties in treatment than does scoliosis. The fact that its cause is still a matter of conjecture and that the progress of the deformity is so often unaffected by treatment, makes it no mean problem for the orthopedist.

At the present time there seems to be some diversity of opinion among surgeons, not only as to the principal factor in its etiology, but likewise in the treatment thereof. It is, therefore, of more than casual interest again to receive the opinion of such a student and observer as Lovett.[1] As the author states in the preface, this, the fourth edition, contains little new in the treatment, perhaps laying a little more stress on the mobilization of the deformed and rigid spine. It would appear to the casual observer and reader that certain factors are at work in scoliosis which have not as yet been brought to light, and that until these insidious forces or changes, which no doubt play at least a passive if not an active rôle in the causation of the disease, are discovered the final and more correct elements of treatment will be wanting.

It is interesting to note that the author at least has the force of his convictions, and has but little altered his views since the appearance of the last edition. In brief, he advocates in the treatment of true scoliosis, removal of the cause if possible, exercise and gymnastics to develop the muscles and mobilize the rigid spine, corrective jackets as a retention, and again, as progress is satisfactory, exercise and gymnastics further to develop muscles and prevent recurrence. During the entire interval, careful consideration is given to the general health of the patient. One cannot help but be impressed with the fact that the logic is correct, and until some new factor is discovered which leads us to change our views as to the causation of scoliosis, the treatment outlined by the author does appear to be the correct one.

JOHN A. WOLFER.

BLOOD transfusion has found its greatest exponents in America, and this procedure is used here far more commonly than in any other country. No doubt in many conditions it becomes a necessary life-saving measure, and since the procedure under these circumstances is so frequently an emergency operation, it behooves even the general practitioner to be more or less familiar with the technique, and to equip himself and his hospital or office with the necessary information and apparatus.

Probably no publication on this subject, at least none that the reviewer is familiar with, is so concise yet brief as is the little volume prepared by Keynes.[2] The author after a short and very interesting chapter on the history of blood transfusion at once enters the subject by giving briefly the indications and uses of blood transfusion. His remarks are definite, and in some instances issue might be taken, yet he clings to generally accepted ideas and does not allow his enthusiasm to lead him astray. The chapters on "Danger of Blood Transfusion" and "Physiology of Blood Groups" are very interesting and instructive, in spite of the fact that practically nothing new is incorporated. The generally accepted methods of blood transfusion are described in detail in the closing chapter.

We are hearing almost daily of reactions during and following a blood transfusion, where theoretically there should be no unfavorable reaction. This would indicate that the final word has not as yet been spoken on this subject, yet for the man who wishes to familiarize himself with this very necessary procedure without the rather laborious task of going over a very considerable literature, this little volume is certainly a valuable asset.

JOHN A. WOLFER.

[1] LATERAL CURVATURE OF THE SPINE AND ROUND SHOULDERS. By Robert W. Lovett, M.D., Sc.D. 4th ed. Philadelphia: P. Blakiston & Sons Co., 1922.

[2] BLOOD TRANSFUSION. By Geoffrey Keynes, M.A., M.D. (Cantab.), F.R.C.S. (Eng.). London: Henry Frowde & Hodder & Stoughton, 1922.

AMERICAN COLLEGE OF SURGEONS

IOWA, SOUTH DAKOTA, MISSOURI, KANSAS, NEBRASKA, OKLAHOMA, TEXAS, NEW MEXICO, LOUISIANA, MISSISSIPPI, ARKANSAS, FLORIDA, GEORGIA, AND ALABAMA SECTIONAL MEETINGS OF THE CLINICAL CONGRESS

DURING the month of January, six sectional meetings of the Clinical Congress of American College of Surgeons were held in various parts of the United States. At these meetings fully 6,000 persons heard of the work of the College in regard to hospital standardization, better health, and scientific surgery. The Fellows of the various states included in the groups came together at clinics and other meetings for mutual benefit. Credentials committee meetings, always well attended, evidenced a strong determination to uphold the high standards of ethics and efficiency required by the College. An important point upon which great emphasis has been placed at all the sectional meetings is that the American College of Surgeons will not under any circumstances countenance the pernicious practice of splitting fees. Sound ethics and the best professional service are required.

IOWA AND SOUTH DAKOTA

THE meeting for Iowa and South Dakota was held at Council Bluffs on January 8 and 9. The local committee of arrangements, of which Dr. Donald Macrae was chairman, had arrangements well in hand. The hospital conference was held in the First Congregational Church at 2 p.m., January 8. There were at least 250 in attendance and hospital standardization and efficient management were discussed from every angle. At the meeting of the Fellows which immediately followed the hospital conference there were some 40 present. Here the organization and work of the College was outlined by the associate director and illustrated by means of slides. The executive committees for the states were elected.

The public meeting held in the Presbyterian Church was attended by approximately one thousand people. Dr. Macrae presided and the program was enthusiastically received. Musical numbers were rendered by the church choir and organist, to whom the appreciation of the College is due. In addition to talks by representatives of the College, the following addresses were delivered:

Experimental Medicine. Harry M. Richter, M.D., Professor of Surgery, Northwestern University Medical School, Chicago.
Some Facts about Cancer. Carl A. Hamann, M.D., Professor of Clinical Surgery, Western Reserve Medical School, Cleveland, Ohio.
The Public and the Surgeon. Dean Lewis, M.D., Professor of Surgery, Rush Medical College, Chicago.

The scientific session was held in the First Congressional Church. There were approximately 75 present. The following interesting program was carried out:

Surgical Aspect of Gall-Tract Diseases. Harry M. Richter, M.D., Chicago.
Hydrocephalus. William E. Sanders, M.D., Des Moines, Iowa.
Chordoma, with Report of a Case. Theodore F. Riggs, M.D., Pierre, South Dakota.
Cleft Lip and Its Surgical Correction. W. H. G. Logan, M.D., Chicago.
Osteomyelitis. Dean Lewis, M.D., Chicago.
Unusual Forms and Locations of Tumors. Carl A. Hamann, M.D., Cleveland, Ohio.

A series of interesting clinics was conducted at the local hospitals on both days of the meeting.

MISSOURI

THE second group meeting, for the Missouri Section, was held at St. Joseph, on January 12 and 13. The headquarters and registration rooms were at the Robidoux Hotel. The local committee, although working at some disadvantage, had arranged an excellent series of meetings and dry clinics. All the meetings were held in the ballroom of the hotel. At the hospital standardization meeting and round table conference there were 125 present and the discussion showed that a keen interest was being taken in the principles of standardization and hospital efficiency. At the meeting of the Fellows which immediately followed the hospital meeting, the Director General gave a short outline of the work of the College. At this

session the state committee was elected for the ensuing year.

The public meeting was attended by approximately 500 and there was a spirit of enthusiasm and earnestness shown throughout the program which was very commendable. The local committee, headed by Dr. Daniel Morton, deserves the greatest credit for its able management, its enthusiasm and attention to detail. At the public meeting the following addresses were given:

The Meaning of the American College of Surgeons to the Public. Franklin H. Martin, M.D., Director General, American College of Surgeons, Chicago.
Factors of Safety in Surgery. Major G. Seelig, M.D., Professor of Clinical Surgery, Washington University, St. Louis.
The Hospital Standardization Program of the American College of Surgeons. Malcolm T. MacEachern, A.M., M.D., President-elect, American Hospital Association.
Experimental Medicine. Harry M. Richter, M.D., Chicago.
Some Facts about Cancer. Carl A. Hamann, M.D., Cleveland, Ohio.
Better Hospitals. Rev. C. B. Moulinier, S.J., President, Catholic Hospital Association.
The Work of the Department of Experts of the Board of Hospitals and Homes of the Methodist Episcopal Church. C. S. Woods, M.D., Chairman, Department of Experts of the Hospitals and Homes of the Methodist Episcopal Church, Indianapolis.
Modern Public Health. Allen Craig, M.D., Associate Director, American College of Surgeons.

Scientific sessions were held in the forenoon of the two days of the meeting. The program shows the excellent type of papers presented.

Friday Session:
Factors Determining the Choice of an Operation in the Surgical Treatment of Glaucoma. W. H. Luedde, M.D., St. Louis.
Arthroplasty. (Motion Pictures.) Frank D. Dickson, M.D., Kansas City.
Surgical Aspects of Gall-Tract Diseases. Harry M. Richter, M.D., Chicago.
Non-Lithogenous Biliary Obstruction as a Factor in Cholecystitis. (Lantern Slides.) Major G. Seelig, M.D., St. Louis.
Saturday Session:
Some Problems in Rural Health Service and State Medicine. Frank G. Nifong, M.D., Columbia, Missouri.
Tumors of the Neck. Carl A. Hamann, M.D., Cleveland, Ohio.
Surgical Repair of Congenital and Acquired Deformities of the Face. (Lantern Slides.) Vilray P. Blair, M.D., St. Louis.
Upper Intestinal Tract Obstruction; Blood Studies and Indications for Treatment. T. G. Orr, M.D., Kansas City, Mo.

KANSAS, NEBRASKA, AND OKLAHOMA

THE third group meeting included the states of Kansas, Nebraska, and Oklahoma, and was held at Topeka, January 15 and 16. Clinics were conducted at the local hospitals. The preliminary arrangements and the carrying on of clinics here devolved largely upon two men, Drs. Stewart and Mills. The hospital conference was one of the best of its type during the month. There were at least 100 present and the enthusiasm was quite marked. The public meeting was attended by approximately 400, and in addition to talks by representatives of the College, the following addresses were given:

Experimental Medicine from a Surgical Standpoint. John Wesley Long, M.D., Emeritus Professor of Gynecology, Medical College of Virginia, Greensboro, North Carolina.
The Work of the Department of Experts of the Board of Hospitals and Homes of the Methodist Episcopal Church. C. S. Woods, M.D., Indianapolis.
Experimental Medicine. Harry M. Richter, M.D., Chicago.

At the annual meeting of Fellows of the College between 30 and 40 were present, and the members of the state committee were elected for the ensuing year.

About 80 attended the scientific session at which the following papers were presented:

Disabling Injuries of the Shoulder. A. R. Mitchell, M.D., Lincoln, Nebraska.
Fractures of the Upper Extremity. Ralph V. Smith, M.D., Tulsa, Okla.
Jejunal Ulcer Following Gastro-Enterostomy for Duodenal Ulcer, with Case Reports. H. L. Snyder, M.D., Winfield, Kansas.
Surgical Aspect of Gall-Tract Diseases. Harry M. Richter, M.D., Chicago.
The Value of Enterostomy in Intestinal Obstruction. John Wesley Long, M.D., Greensboro, North Carolina.
Pulmonary Tuberculosis in relation to Surgery. Allen Craig, M.D., Chicago.

TEXAS AND NEW MEXICO

THE fourth group meeting, for the states of Texas and New Mexico, was held at Temple, Texas, January 19 and 20. The arrangements were in charge of an energetic local committee, with Dr. Scott as chairman. There was a very marked enthusiasm and evidence of attention to detail. Apparently no effort had been spared to make the meeting successful. Clinics were held in the local hospitals and the scientific sessions and public meeting in the First Methodist Church. Approximately 250 attended the hospital conference. About 60 were present at the meeting of the Fellows at which the election of committees for the ensuing year took place.

At the public meeting there were present approximately 1700 people. It was one of the most enthusiastic meetings of this type which the College has had. The organist of the Church

very kindly provided music. Dr. Bacon Saunders presided. Dr. Craig, associate director of the College, outlined the work of the College in relation to public health problems, and Dr. MacEachern discussed the hospital standardization program of the College. Dr. Long spoke upon "Experimental Medicine from a Surgical Standpoint"; Dr. Robert Jolly of Houston, Texas, on "How You Can Help Your Hospital."

The scientific session was attended by approximately 125 and all the papers presented were well prepared and thoroughly discussed.

LOUISIANA, MISSISSIPPI, AND ARKANSAS

IN the fifth group meeting for the month of January, the states of Louisiana, Mississippi, and Arkansas were represented. The meeting was held in Shreveport, Louisiana, on January 22 and 23. Dr. Thomas Ragan and his committee very successfully cared for the local arrangements. The meetings were held at the Youree Hotel. Approximately 200 attended the hospital meeting and round table conference, and 35 the meeting of the Fellows, at which officers for the ensuing year were elected. Owing to the serious illness in his family, Dr. Malcolm T. MacEachern was unable to be at the meeting. His place on the program was very ably taken by Dr. F. P. Miller of El Paso, Texas, who gave two excellent discussions on hospital standardization and conducted the round table conference.

The public meeting held in the ballroom of the hotel was attended by some 500, and the enthusiasm of those present was an evidence of the interest of the people in the better health movement and in hospital standardization. At this meeting the program of the College was outlined by its representatives and other problems discussed by eminent surgeons. Forty were present at the scientific meeting held on the afternoon of the second day, at which papers were read.

FLORIDA, GEORGIA, AND ALABAMA

AT the sixth group meeting for January, Florida, Georgia, and Alabama were represented. This meeting was held in Jacksonville, Florida, January 29 and 30. The hospital conference and scientific meetings were conducted at the Seminole Hotel. Clinics and demonstrations were given at the local hospitals. The public meeting was attended by 1000 people. Music was provided by the organists of the Church and also by the harpist. These numbers were very much appreciated. Addresses were delivered by representatives of the College and other speakers as follows:

Some Facts about Cancer. Carl A. Hamann, M.D., Cleveland, Ohio.

Experimental Medicine from a Surgical Standpoint. John Wesley Long, M.D., Greensboro, North Carolina.

History of Anæsthesia and Anæsthetics. Stuart McGuire, M.D., President and Professor of Surgery, Medical College of Virginia, Richmond.

How You Can Aid Your Hospital. Robert Jolly, Superintendent, Baptist Hospital, Houston, Texas.

At the scientific session on the second day 120 were present and papers were presented as follows:

The Influence of Hæmorrhage on the Mortality in Gunshot Wounds and other Injuries of the Abdomen, with an Analysis of Sixty-Nine Cases. James M. Mason, M.D., Birmingham, Alabama.

The Ureter versus the Appendix in Right-Sided Abdominal Lesions. J. N. Baker, M.D., Montgomery, Alabama.

Teaching Obstetrics. Joseph Akerman, M.D., Augusta, Georgia.

Accidents Liable to Happen to Benign Tumors of the Ovaries. Thomas P. Waring, M.D., Savannah, Georgia.

The Value of Enterostomy in Intestinal Obstructions. John Wesley Long, M.D., Greensboro, North Carolina.

Treatment of Certain Types of Goiter. Stuart McGuire, M.D., Richmond.

Unusual Forms and Locations of Tumors. Carl A. Hamann, M.D., Cleveland, Ohio.

The clinics conducted in the various hospitals were carefully arranged by the committee in charge and well carried out. The Jacksonville meeting was very successful and its success was due to the energetic efforts of Dr. Gerry R. Holden and his local committee.

As will be noted the usual plan of having the hospital conference on the afternoon of the first day, the public meeting at night, the scientific meeting on the second day, and clinics in the morning, has been carried out. Meetings of the Fellows were held following the hospital conference. At these meetings the organization and work of the College has been carefully gone over and illustrated by means of lantern slides. In this way every member has had an opportunity of knowing of the work being carried on at headquarters. Constructive suggestions have been invited and the various problems of the individual states discussed.

The program of hospital standardization and better health is now soundly established. Everywhere there has been favorable commendation in this regard from both the public and the press. One could not speak too highly of the support and enthusiastic co-operation received from the churches, women's clubs, rotary clubs, and the press. To all who have so ably assisted in these very successful meetings during the month of January the College extends grateful thanks.